Permit No.	Date	DIN
9401	**August 30, 2010**	**11480**

RECEIVED
August 16, 2010
Solid Waste Section
Asheville Regional Office

RMT
• ENVIRONMENT • ENERGY • ENGINEERING

August 13, 2010

Mr. Larry Frost
Environmental Engineer
North Carolina Department of Natural Resources (NCDENR)
2090 US Highway 70
Swannanoa, North Carolina 28778

Dear Mr. Frost:

This letter serves to document two design variances requested by RMT during your visit to Domtar's Landfill No. 3 in Plymouth, NC on June 10, 2010 in regards to the closure of Phase 1a and 1b.

The first variance was the design change of downslope flume pipes and energy dissipaters replacing the previously specified articulated block channels. It has been RMTs experience in construction, operation, and maintenance that the downslope flume design is superior to articulated block channels. Revised stormwater calculations and design drawings are given in the *Erosion and Sediment Control Plan (ESCP) for Landfill No. 3 Phase 1a and 1b Closure* (RMT, 2010). A copy of the design drawings, including details and specifications, is given as Attachment 1 to this letter.

The Construction Permit Application for On-Site Industrial Waste Landfill No. 3 (RMT, 1999), Phase 1B and Phase 2 Construction Plan Application for On-Site Industrial Waste Landfill Number 3 (RMT, 2002), and Phase 3 and Phase 4 Construction Plan Application for On-Site Industrial Waste Landfill Number 3 (RMT, 2008, Amended 2009), describe a select waste layer meant to protect the geocomposite layers from potential damage during construction activities. Current grading activities by mill contractors to bring the waste material to final grade have ensured a select ash fill layer is present, and objects that could possibly damage the composite liner during or after construction have been removed. Based on your visual observation during your June 2010 visit, a verbal agreement was made to eliminate the need for a survey of the bottom of the select waste layer. The top of the select ash fill layer will be surveyed prior to construction of the composite liner to ensure that final waste elevations have been met.

I:\WPGVL\PJT\00-71717\41\L007171741-003.DOCX

Please contact me if you have any questions at (864)234-9462.

Sincerely,

RMT North Carolina, Inc.

Travis Tarbet for

Mike Parker
Senior Client Service Manager

Attachments

cc: Todd Martin
Travis Tarbet
Central Files

Attachment 1
Design Drawings

Table of Contents

Section		Pages
	DIVISION 1	
01270	Measurement and Payment	01270 -1 - 01270-6
01310	Administrative Provisions	01310 -1 - 01310-3
01314	Project Meetings	01314 -1 - 01314-1
01330	Submittals	01330 -1 - 01330-2
01410	Regulatory Requirements	01410 -1 - 01410-1
01420	Reference Standards	01420 -1 - 01420-1
01450	Quality Control	01450 -1 - 01450-1
01452	Testing Laboratory Services	01452 -1 - 01452-3
01520	Construction Facilities and Temporary Controls	01520 -1 - 01520-2
01570	Temporary Controls	01570 -1 - 01570-2
01574	Temporary Water Control	01574 -1 - 01574-1
01600	Material and Equipment	01600 -1 - 01600-3
01720	Field Engineering	01720 -1 - 01720-2
01760	Monitoring Well Protection	01760 -1 - 01760-1
01770	Contract Closeout	01770 -1 - 01770-2
	DIVISION 2	
02072	Linear Low-Density Polyethylene (LLDPE) Geomembrane	02072 -1 - 02072-21
02075	Geosynthetic Clay Liner	02075 -1 - 02075-12
02076	Geotextiles	02076 -1 - 02076-6
02078	Drainage Geocomposite	02078 -1 - 02078-13
02232	Clearing and Grubbing	02232 -1 - 02232-1
02315	Excavation	02315 -1 - 02315-3
02317	Trenching, Backfilling, and Compaction	02317 -1 - 02317-3
02320	Fill	02320 -1 - 02320-6
02372	Riprap	02372 -1 - 02372-2
02374	Erosion Control Fence	02374 -1 - 02374-4

02376	Erosion Control Material	02376 -1 - 02376-2
02536	Outlet Stabilization Structure	02536 -1 - 02536-2
02618	High-Density Polyethylene (HDPE) Pipe and Fittings	02618 -1 - 02618-4
02720	Aggregate Base Course	02720 -1 - 02720-2
02743	Downslope Flume (Chutes)	02743 -1 - 02743-2
02911	Topsoil	02911 -1 - 02911-1
02921	Seeding	02921 -1 - 02921-3
02923	Fertilizing	02923 -1 - 02923-2

BID FORM

NEW LANDFILL NO.3
PHASE 1A & 2B
CLOSURE PLAN
DOMTAR COMPANY
PLYMOUTH, NORTH CAROLINA

ITEM NO.	ITEM OF WORK	ESTIMATED QUANTITY	UNITS	UNIT PRICE/ LUMP-SUM COST	TOTAL COST
001	Mobilization and Demobilization	1	LS		
002	Sediment Control Fence	4,400	LF		
003	Grade Select Ash Layer	80	HR		
004	Surface Gas Venting System	1	LS		
005	Geosynthetic Clay Liner (GCL)	1	LS		
006	40-mil LLDPE Textured Geomembrane	1	LS		
007	Geocomposite Drainage Layer	1	LS		
008	Perimeter Drainage Layer Discharge/Ditch System	1	LS		
009	Grouted Riprap	1	LS		
010	Elevate Roadway Grade	1	LS		
011	Borrow Site Preparation and Restoration	1	LS		
012	General Fill/Vegetative Support Layer	1	LS		
013	Downslope Flumes	1	LS		
014	Topsoil (Landfill Cover)	1	LS		
015	Permanent Seed and Mulch	22	AC		
016	Temporary Seed and Mulch	3	AC		
017	Erosion Control and Revegetation Mat (ECRM)	1	LS		
018	Turf Reinforcement Mat (TRM)	1	LS		
019	Fertilizer	12.5	TONS		
020	Lime	25	TONS		
				Total Base Price	$

TOTAL OF COSTS: _____($_____)
(use words) (dollars)

Refer to Section 01270 (Measurement and Payment) for descriptions of bid items. Quantities are not guaranteed. Final payment will be based on actual quantities.

BID FORM (CONTINUED)

NEW LANDFILL NO.3
PHASE 1A & 2B
CLOSURE PLAN
DOMTAR COMPANY
PLYMOUTH, NORTH CAROLINA

BIDDER also agrees to perform additional work on a time-and-materials basis using the BIDDER's list of equipment and the BIDDER unit hourly rate listed below. BIDDER will include the cost of an operator in the unit hourly rate of the equipment. Include in this equipment list make, model, and/or size of each piece of equipment. BIDDER may attach company list with rates. Time-and-materials work performed not using a specified equipment rate will be paid based on an equivalent or the next lower specified equipment rate.

BIDDER's Equipment with Operator	Unit Hourly Rate
_____	$ _____ /hr
_____	$ _____ /hr
_____	$ _____ /hr
_____	$ _____ /hr
_____	$ _____ /hr
_____	$ _____ /hr
_____	$ _____ /hr
_____	$ _____ /hr
_____	$ _____ /hr
Laborer _____	$ _____ /hr
Foreman with pickup _____	$ _____ /hr

Contractor shall provide anticipated Schedule with proposal.

BIDDER has examined copies of all the Bidding Documents and Addenda (numbers __), receipt of which is hereby acknowledged.

_____
Bidder

_____ _____
Signed Date

SECTION 01270
MEASUREMENT AND PAYMENT

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Procedures for unit price measurement and payment.

B. Schedule of unit prices.

1.2 PROCEDURES

A. Unit Price Bid is full compensation for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the Work under that item.

B. OWNER will pay CONTRACTOR for the actual amount of Work completed on the basis of final quantities measured in place, load tickets, or plan quantities where specified.

C. Completed Work will be measured by ENGINEER according to U.S. Standard measure units to determine final quantities.

D. Pay items based on in-place volumes will be determined by the method of average end areas or computer generated digital terrain models based on field cross sections unless otherwise noted.

E. Deliver all materials specified to be measured by the load ticket for tons or cubic yards in vehicles with legible identification numbers or marks.

F. Clearly mark truck box volume on vehicles hauling materials to be measured by the cubic yard.

G. Weigh materials to be measured by the ton on state-certified platform scales.

H. Show on each load ticket the type of material, the volume or weights (gross, tare, net), the vehicle identification number or marks, the date, and the source of the material. Deliver load tickets to the Construction Manager within 24 hours after materials are delivered.

1.3 SCHEDULE OF UNIT PRICES

A. Description of Unit Prices

ITEM 1 MOBILIZATION AND DEMOBILIZATION

Measure and pay for Mobilization and Demobilization by the lump sum. This item of Work includes, but is not limited to, the work and operations necessary for the transportation of equipment and training and movement of personnel to the project site, and for all other work and operations which must be performed before beginning work at the project site. Include field office trailers, equipment trailers, construction staking/surveying, obtaining required construction related permits, bonds and insurance, and administrative costs. Work also includes work associated with complying with the Phase 1A and 1B and Borrow Area and Haul Road Erosion and Sediment Control Plans, dated July 2010. Fifty percent of this item will be paid as demobilization at the end of the project.

ITEM 2 SEDIMENT CONTROL FENCE

Measure and pay for Sediment Control Fence by the linear foot. This item of Work includes furnishing and installing Sediment Control Fence to control sediment migration from construction and borrow site operations in accordance with the Sediment and Erosion Control Plan, applicable state and local codes, ordinances, and as required by Drawings and Specifications. This item of Work also includes maintaining the Sediment Control Fence during construction. Sediment Control Fence will be installed as shown on the drawings around the borrow area, soil stockpiles, and at other locations determined by the OWNER and /or ENGINEER. Measurements will be determined in the field.

ITEM 3 GRADE SELECT ASH LAYER

Measure and pay for Grade Select Ash Layer by time-and-materials. This item of Work includes fine-grading and smooth drum–rolling the select ash surface, so that it is free of irregularities, protrusions, loose soil, and abrupt changes in grade in accordance with the Drawings and Specifications. This item of Work includes removing stones, waste materials, grade stakes, and other debris that may be damaging to the geosynthetic clay liner (GCL) and geocushion. Provide equipment and labor (for bid comparison purposes assume a crew consisting of two dozers [CAT D6 or equivalent], one backhoe [CAT 225 or equivalent], one smooth-drum roller, one off-road dump truck, four operators, grade control, and one foreman with pickup will be required for a duration of 80 hours) to prepare the Select Ash Layer for GCL installation. An allowable elevation tolerance of -0.10 to +0.10 foot from the design top of select ash layer elevation is required at each 50-foot minimum grid documentation location. If needed, on-site select ash will be used to fill areas that are below design grades to ensure a uniform surface free of irregularities. This item of Work includes maintaining the surface until GCL and geomembrane installation is complete. Payment will be determined by actual time and materials recorded by the CONTRACTOR and approved by OWNER's representative on a daily basis.

ITEM 4 SURFACE GAS VENTING SYSTEM

Measure and pay for Surface Gas Venting System by the lump sum. This item of Work includes, but is not limited to, miscellaneous excavating, trenching and disposing of excess material/waste, and furnishing and installing geotextile, HDPE pipe, crushed stone, bentonite seal, pipe boot, concrete mowing strip, concrete encasement, stainless steel turbine ventilator, and appurtenances to construct the surface gas venting system in accordance with the Drawings and Specifications.

ITEM 5 GEOSYNTHETIC CLAY LAYER (GCL)

Measure and pay for Geosynthetic Clay Liner (GCL) by the lump sum. This item of Work includes, but is not limited to, furnishing, deploying, and seaming the GCL material above the compacted select ash layer. This item includes providing and installing bentonite for seaming and repairs, documenting the panel layout, and constructing all GCL pipe penetrations in accordance with manufactures recommendations and the Drawings and Specifications. This item of Work includes providing and installing temporary plastic sheeting or other items and appurtenances to protect on-site stored GCL and the leading edge of the GCL from moisture and saturation at the end of each day. This item of Work includes unloading GCL delivered to the site, verifying that the rolls delivered match the GCL roll list provided and certified by the GCL manufacturer, and storing and protecting the GCL rolls on-site. Removing and replacing GCL rolls or GCL panels that have become saturated is considered incidental to this item.

ITEM 6 40-MIL LLDPE TEXTURED GEOMEMBRANE

Measure and pay for 40-mil LLDPE Textured Geomembrane by the lump sum. This item of Work includes furnishing, deploying, and installing the geomembrane material above the GCL, and performing the specified testing, documentation, and repairs of the geomembrane panels and seams. This item of Work includes constructing all pipe boots and welding the final cover geomembrane to the base liner geomembrane around the perimeter of the landfill cover as shown on the Drawings. This item of Work also includes unloading goemembrane rolls delivered to the site, verifying that the rolls delivered match the geomembrane roll list provided and certified by the geomembrane manufacturer, and protecting the stored geomembrane rolls on-site. Providing and using rub sheets for deploying the geomembrane above the GCL is considered incidental to this Bid item.

ITEM 7 GEOCOMPOSITE DRAINAGE LAYER

Measure and pay for Geocomposite Drainage layer by the lump sum. This item of Work includes, but is not limited to furnishing, deploying, and installing the geocomposite drainage layer material above the geomembrane liner and as indicated on the Drawings, providing and installing plastic ties to connect the geogrid portion of the geocomposite, sewing of the upper geotextile, and repairing damaged geocomposite panels and seams. This item of Work also includes furnishing and installing plywood and metal T-posts at final cover termination in accordance with the Drawings and Specifications. This item of Work includes unloading geocomposite rolls delivered to the site, verifying that the rolls delivered match the geocomposite roll list provided and certified by the geocomposite manufacturer, and protecting the stored geocomposite rolls on-site. Providing and using rub sheets for deploying the geocomposite above the geomembrane is considered incidental to this Bid item.

ITEM 8 PERIMETER DRAINAGE LAYER DISCHARGE/DITCH SYSTEM

Measure and pay for the Perimeter Drainage Layer Discharge/Ditch System by the lump sum. This item of Work includes, but is not limited to, excavating material to expose the base liner and to construct the ditch subbase around the perimeter of the landfill, cleaning the base liner to allow welding of the final cover geomembrane to the base liner geomembrane and to remove entrapped material/debris between the final cover geomembrane and base liner geomembrane on the outer sideslope of the base liner, and preparing the leachate cleanouts for pipe boot installation. This item of work includes furnishing and installing geocushion. This item of Work also includes extending the leachate cleanouts pipes on the base liner as necessary to match final conditions of the constructed final cover and raised perimeter access road. This item of work also includes furnishing and installing 4-inch-diameter perforated, corrugated, polyethylene drainage pipe with smooth interior, 4-inch–diameter non-perforated polyethylene drainage outlet pipe, 4-inch–diameter (SDR 21) HDPE drainage outlet pipe, fittings, geotextile filter, select aggregate fill, riprap, miscellaneous excavating, backfilling, bentonite plug at each outlet, and appurtenances for the terrace and perimeter drainage ditch as required by the Drawings and Specifications.

ITEM 9 GROUTED RIPRAP

Measure and pay for Grouted Riprap by the lump sum. This item of Work includes, but is not limited to, miscellaneous excavating, backfilling, and compacting required for installation of grouted riprap at the energy dissipaters and at the downslope flume inlets. This item of Work includes furnishing and installing geotextile, No. 57 stone, riprap, concrete grout, and appurtenances in accordance with the Drawings and Specification.

ITEM 10 ELEVATE ROADWAY GRADE

Measure and pay for Elevate Roadway Grade by the lump sum. This item of Work includes, but is not limited to, stripping and salvaging topsoil, miscellaneous excavating, filling, grading, and compacting as required to raise the road grade on the western side of the final cover to the finish grades shown on the Drawings. Work includes furnishing and installing road geotextile, compacted general fill, base course, and replacing the salvaged topsoil after construction of the road is complete. Roadway grade will be raised by filling and constructing a new road over the existing road.

ITEM 11 BORROW SITE PREPARATION AND RESTORATION

Measure and pay for Borrow Site Preparation and Restoration by the lump sum. This item of Work includes, but is not limited to, constructing access to the borrow site, clearing and grubbing, stripping and stockpiling topsoil in the designated topsoil stockpile area or placing directly on the final cover, providing surface water controls to provide positive drainage to the existing outlet structure, and temporary dust control measures. Work also includes maintaining access to the borrow site throughout construction and grading of the borrow area after construction is complete to provide positive drainage to the existing drainage structure. The borrow area will not be required to be topsoiled after construction is complete. Pile cleared and grubbed material in a location of the borrow area agreed upon with the OWNER. OWNER will dispose of the piled cleared and grubbed material. Seeding, fertilizing, and mulching of the borrow area is paid for under the Seed, Fertilize, and Mulch Bid Item 15. Restoration of permanent access roads to conditions equivalent to preconstruction condition is considered incidental to this bid item.

ITEM 12 GENERAL FILL/VEGETATIVE SUPPORT LAYER

Measure and pay for General Fill/Vegetative Support Layer by the lump sum. This item of Work includes excavating General Fill from the OWNER-provided on-site borrow area, hauling, placing, and fine-grading in accordance with the Drawings and Specifications. A minimum 1.0-foot–thick general fill/vegetative support layer is required, with an allowable tolerance of 0.0 to +0.20 foot. The general fill/vegetative support layer cannot be placed from the top of the slope down when the slope is greater than 6H:IV. Double-handling of General Fill material is incidental to this bid item.

ITEM 13 DOWNSLOPE FLUMES

Measure and pay for Downslope Flumes by the lump sum. This item of Work includes, but is not limited to, miscellaneous excavating, backfilling, and compacting required for installation of the Downslope flumes and installing additional general fill over and around the downslope flume pipes. This item of Work also includes furnishing and installing HDPE pipe, inlet end sections, outlet end sections, child grates, fittings, concrete backfill at pipe connection to energy dissipaters, energy dissipaters, geotextile, anti-seep geomembrane, anti-seep collars, and appurtenances in accordance with the Drawings and Specification.

ITEM 14 TOPSOIL (LANDFILL COVER)

Measure and pay for Topsoil by the lump sum. This item of Work includes excavating topsoil from the OWNER-provided on-site stockpile area or from topsoil stripped from the general fill borrow area, loading, hauling, placing, and finish-grading the area over the general fill/vegetative support layer to a minimum thickness of 6 inches with an allowable tolerance of 0.0 to +0.10 foot. Double-handling of topsoil is incidental to this bid item. Fine grading of topsoil is included in Temporary Seed and Mulch Bid Item 15 and Permanent Seed and Mulch Bid Item 16.

ITEM 15 TEMPORARY SEED AND MULCH

Measure and pay for Temporary Seed and Mulch by the acre. This item of Work includes fine grading of topsoil, seedbed preparation, seeding, mulching, maintenance, and repair (reseeding as necessary) in accordance with the Drawings and Specifications. Temporary Seed and Mulch disturbed areas where vegetative cover is needed for less than 1 year. Areas include temporary diversions, dams, and stockpiles. Temporary seed areas will be determined by OWNER or ENGINEER. Area measurements will be based on planimetric areas determined in the field.

ITEM 16 PERMANENT SEED AND MULCH

Measure and pay for Permanent Seed and Mulch by the acre. This item of Work includes fine grading of topsoil, seedbed preparation, seeding, mulching, maintenance, and repair (reseeding as necessary) in accordance with the Drawings and Specifications. Seed and mulch the borrow area, final cover area, and all disturbed areas that require vegetative cover for more than 1 year. Area measurements will be based on planimetric areas determined in the field.

ITEM 17 EROSION CONTROL REVEGETATION MAT (ECRM)

Measure and pay for Erosion Control and Revegetation Mat (ECRM) by the lump sum. This item of Work includes furnishing and installing ECRM at the locations indicated on the Drawings. This item of Work includes, but is not limited to installing, overlapping, trenching, and anchoring per manufacturer's recommendation and maintaining the ECRM until vegetation has been established.

ITEM 18 TURF REINFORCEMENT MAT (TRM)

Measure and pay for Turf Reinforcement Mat (TRM) by the lump sum. This item of Work includes furnishing and installing TRM at the locations indicated on the Drawings. This item of Work includes, but is not limited to installing, overlapping, trenching, and anchoring per manufacturer's recommendation and maintaining the TRM until vegetation has been established.

ITEM 19 FERTILIZER

Measure and pay for Fertilizer by the ton. This item of work includes, but is not limited to, furnishing and installing fertilizer over permanent and temporary seeded area. Work also includes providing topsoil sampling and testing to determine fertilizer application rates. Measurement will be based on weight tickets or bag counts in the field.

ITEM 20 LIME

Measure and pay for Lime by the ton. This item of work includes, but is not limited to, furnishing and installing lime to amend the topsoil in permanent and temporary seeding areas. Work also includes providing topsoil sampling and testing to determine lime application rates. Measurement will be based on weight tickets.

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

NOT USED.

END OF SECTION

SECTION 01310
ADMINISTRATIVE PROVISIONS

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Work Covered by Contract Documents.

B. Contract Method.

C. Work Sequence.

D. CONTRACTOR Use of Premises and OWNER Occupancy.

E. OWNER-furnished Products.

F. Alternates.

G. Applications for Payment.

H. Coordination.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. Work of this Contract includes, but is not limited to the following activities:

- Mobilization and demobilization
- Installing sediment control fence and other surface water controls
- Finish grading the Select Ash layer to prepare top of waste for GCL installation
- Constructing a gas venting system
- Installing GCL
- Installing 40-mil LLDPE textured geomembrane
- Installing a geocomposite drainage layer
- Constructing a perimeter drainage layer discharge/ditch system
- Installing grouted riprap
- Raising roadway grades
- Preparing and restoring the OWNER-provided borrow site
- Constructing a General Fill/vegetative support layer
- Installing downslope flumes, energy dissipaters, and drainage layer discharge piping
- Stripping and installing topsoil
- Seeding, fertilizing, and mulching
- Installing erosion control revegetation mat (ECRM) and turf reinforcement mat (TRM)

1.3 CONTRACT METHOD

A. Construct the Work under a unit price Contract.

B. Compensation is full payment for furnishing all materials, labor, equipment, tools, and incidentals necessary to complete the Work.

1.4 WORK SEQUENCE

A. Maintaining the schedule for this project is critical. Provide a detailed work schedule of the entire project to keep OWNER and ENGINEER informed of construction progress and any conditions which affect the prosecution of the work. Prior to commencing work, CONTRACTOR shall submit the schedule to ENGINEER for approval. When schedule changes are necessary, provide an updated schedule of the entire project to the OWNER and ENGINEER at weekly progress meetings throughout construction.

Regulate operations, work shifts, and work force to maintain the schedule.

B. Install all necessary temporary controls and facilities, such as erosion control measures and field offices, prior to the start of construction.

1.5 CONTRACTOR USE OF PREMISES AND OWNER OCCUPANCY

A. Limit use of premises to Work and construction operations; allow for OWNER's operations.

B. Coordinate use of premises under direction of ENGINEER. Cooperate with ENGINEER to minimize conflict and to facilitate OWNER's operations.

C. Limit access to site through the main gate. Personnel must check in and out each time that they enter/leave the site.

1.6 OWNER-FURNISHED PRODUCTS

A. Products furnished by OWNER:

- Water for construction and dust control
- Select Ash
- General Fill
- Topsoil

1.7 APPLICATIONS FOR PAYMENT

A. Submit three copies of each application under procedures of Section 01330.

B. Content and Format: Application for Payment form format will be agreed upon by OWNER.

1.8 COORDINATION

A. Coordinate and integrate elements of Work of the various Sections of Specifications to ensure efficient and orderly sequence of installation with provisions for accommodating items installed later.

B. Verify that characteristics of elements of interrelated operating equipment are compatible; coordinate Work of various Specification sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

NOT USED.

END OF SECTION

SECTION 01314
PROJECT MEETINGS

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Preconstruction conferences.

B. Progress meetings.

1.2 PRECONSTRUCTION CONFERENCES

A. ENGINEER will administer Preconstruction Conference to discuss schedules, procedures, submittals, payments, and establish a working understanding among parties.

B. Attendance: Project Manager, Job Superintendent, major subcontractors and suppliers (including geosynthetic installer), Construction Manager, OWNER, ENGINEER, as appropriate for topics on the agenda for each meeting.

1.3 PROGRESS MEETINGS

A. Construction Manager will schedule and administer Project meetings throughout progress of the Work at maximum weekly intervals.

B. Construction Manager will make physical arrangements for meetings, prepare agenda with copies for participants, preside at meetings, record minutes, and distribute copies within two days to ENGINEER, participants, and those affected by decisions made at meetings.

C. Attendance: Job Superintendent, major subcontractors and suppliers, Construction Manager, OWNER, ENGINEER as appropriate to topics on the agenda for each meeting.

D. Suggested Agenda: Review Work progress, status of construction schedule and adjustments thereto, equipment and material, delivery schedules, submittals, adherence to quality standards, pending changes and substitutions, coordination, and other items affecting the progress of Work.

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

NOT USED.

END OF SECTION

SECTION 01330
SUBMITTALS

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Procedures.

B. Construction Progress Schedules.

C. Shop Drawings.

D. Product Data.

E. Manufacturer's Instructions.

F. Samples.

G. CONTRACTOR Review.

1.2 PROCEDURES

A. Deliver submittals to ENGINEER.

B. Identify Project, CONTRACTOR, Subcontractor, major Supplier; identify pertinent Drawing sheet and detail number, and Specification Section number, as appropriate. Identify deviations from Contract Documents.

C. Comply with construction schedule for submittals related to Work progress. Coordinate submittal of related items.

D. After ENGINEER reviews submittal, revise and resubmit as required; identify changes made since previous submittal.

E. Distribute copies of reviewed submittals to concerned persons. Instruct recipients to promptly report any inability to comply with provisions.

1.3 CONSTRUCTION PROGRESS SCHEDULE

A. Submit horizontal bar chart with separate bar for each major trade, subcontractor, or operation, identifying first Work day of each week.

B. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Show projected percentage of completion of each item of Work at each Application for Progress Payment.

C. Show submittal dates required for shop drawings, product data, samples, and product delivery dates.

1.4 SHOP DRAWINGS

A. Submit the number of opaque reproductions which CONTRACTOR requires, plus two copies which will be retained by ENGINEER.

B. Present in a clear and thorough manner. Title each drawing with Project name; identify each element of Drawings by reference to sheet number and detail of Contract Documents.

C. Identify field dimensions; show relationship to adjacent or critical features of Work or products.

1.5 PRODUCT DATA

A. Mark each copy to identify applicable product, models, options, and other data; supplement manufacturer's standard data to provide information unique to the Work.

B. Submit the number of copies which CONTRACTOR requires plus two copies which will be retained by ENGINEER.

1.6 MANUFACTURER'S INSTRUCTIONS

A. When required by an individual Specification Section, submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for product data.

1.7 SAMPLES

A. Provide field samples as required by individual Specifications Sections.

B. Submit samples to illustrate functional characteristics of the product, with integral parts and attachment devices. Coordinate submittal of different categories for interfacing Work.

C. Include identification on each sample, giving full information.

1.8 CONTRACTOR REVIEW

A. Review submittals prior to transmittal; determine and verify field measurements, field construction criteria, manufacturer's catalog numbers, and conformance of submittal with requirements.

B. Coordinate submittals with requirements of Work and of Contract Documents.

C. Sign or initial each sheet of shop drawings and product data, and each sample label to certify compliance with requirements of Contract Documents. Notify ENGINEER in writing at time of submittal of any deviations from requirements of Contract Documents.

D. Do not fabricate products or begin Work which requires submittals until return of submittal with ENGINEER's acceptance.

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

NOT USED.

END OF SECTION

SECTION 01410
REGULATORY REQUIREMENTS

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Description.

B. Permits.

C. Taxes.

1.2 DESCRIPTION

A. Give all notices; observe and comply with all laws, rules, regulations and ordinances applicable to the Work.

B. Notify area utility companies (North Carolina 811) before beginning Work, in accordance with state and local regulations.

1.3 PERMITS

A. Obtain and pay for all construction permits and licenses and pay all governmental charges and inspection fees necessary for the prosecution of the Work, which are applicable at the time of CONTRACTOR's Bid.

B. OWNER will assist CONTRACTOR, when necessary, in obtaining such permits and licenses.

1.4 TAXES

A. Pay all sales, consumer, use and other similar taxes required to be paid in accordance with the law of the place where the Work is to be performed.

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

NOT USED.

END OF SECTION

SECTION 01420
REFERENCE STANDARDS

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Applicability of Reference Standards.

B. Provision of Reference Standards at site.

1.2 QUALITY ASSURANCE

A. Comply with requirements of the standard for products or workmanship specified by association, trade, or federal standards, except when more rigid requirements are specified or are required by applicable codes.

B. Except when a specific date is specified, the date of the standard is that in effect as of the Bid date, or date of the OWNER-CONTRACTOR Agreement when there are no bids.

C. When required by individual Specifications Section, obtain copy of standard. Maintain copy at job site during submittals, planning, and progress of the specific Work, until Substantial Completion.

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

NOT USED.

END OF SECTION

SECTION 01450
QUALITY CONTROL

PART 1. GENERAL

1.1 SECTION INCLUDES

A. General Quality Control.

B. Workmanship.

C. Manufacturer's Instructions.

D. Manufacturer's Certificates.

E. Manufacturer's Field Services.

1.2 GENERAL QUALITY CONTROL

A. Maintain quality control over suppliers, manufacturers, products, services, site conditions, and workmanship to produce Work of specified quality.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform Work by persons qualified to produce workmanship of specified quality.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence. Should instructions conflict with Contract Documents, request clarification from ENGINEER before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required by individual Specifications Section, submit manufacturer's certificate, in duplicate, that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When specified in respective Specification Sections, require Manufacturer to provide qualified personnel to observe field conditions, conditions of surfaces and installation, quality of workmanship, as applicable, and to make appropriate recommendations.

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

NOT USED.

END OF SECTION

SECTION 01452
TESTING LABORATORY SERVICES

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Reference Standards.

B. Selection and Payment.

C. Laboratory Responsibilities.

D. Laboratory Reports.

E. Limits on Testing Laboratory Authority.

F. CONTRACTOR Responsibilities.

G. Soils Testing.

H. Geosynthetics Testing.

1.2 REFERENCE STANDARDS

A. ANSI/ASTM D3740 - Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

B. ANSI/ASTM E329 - Specification for Agencies Engaged in Testing and/or Inspection of Materials Used in Construction.

C. Reference Standards contained in DIVISION 2 – SITE WORK.

1.3 SELECTION AND PAYMENT

A. OWNER will employ and pay for services of an independent testing laboratory to perform specified inspection and testing.

B. Employment of testing laboratory shall in no way relieve CONTRACTOR of obligation to perform Work in accordance with requirements of Contract Documents.

1.4 LABORATORY RESPONSIBILITIES

A. Test samples of materials submitted by CONTRACTOR.

B. Provide qualified personnel at site after due notice; cooperate with ENGINEER and CONTRACTOR in performance of services.

C. Perform specified inspection, sampling and testing of products in accordance with specified standards.

D. Determine compliance of materials with requirements of Contract Documents.

E. Promptly notify ENGINEER of observed irregularities or non-conformance of Work or products.

F. Perform additional inspections and tests until compliance is achieved or as required by ENGINEER.

1.5 LABORATORY REPORTS

A. After each inspection and test, promptly submit two copies of laboratory report to ENGINEER. Include: Date issued, Project Title and number, name of inspector, date and time of sampling or inspection, identification of product and Specifications section, location in the Project, type of inspection or test, date of test, results of test, and conformance with Contract Documents. When requested by ENGINEER, provide interpretation of test results.

1.6 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory may not release, revoke, alter, or enlarge on the requirements of Contract Documents.

B. Laboratory may not approve or accept any portion of the Work.

C. Laboratory may not assume any duties of CONTRACTOR.

D. Laboratory has no authority to stop Work.

1.7 CONTRACTOR RESPONSIBILITIES

A. Cooperate with ENGINEER and laboratory personnel, and provide access to Work.

B. Provide incidental labor and facilities to provide access to Work to be tested, to obtain and handle samples at the site or at the source of products to be tested, to facilitate tests and inspections, and for storage and curing of test samples.

C. Notify ENGINEER and laboratory of operations requiring inspection and testing services 24 hours before services are needed.

D. If tests indicate Work does not meet specified requirements, remove Work, replace, and retest until compliance is achieved at no cost to OWNER.

1.8 SOILS TESTING

A. OWNER will perform soils testing in accordance with Section 02320.

1.9 GEOSYNTHETICS TESTING

A. OWNER will provide the following geosynthetics testing:

- Conformance Testing in accordance with Sections 02072, 02075, 02076, and 02078.
- Destructive Testing (laboratory testing) in accordance with Section 02072.

B. CONTRACTOR will provide the following geosynthetics testing:

- Manufacturer's Quality Control Testing in accordance with Sections 02072, 02075, 02076, and 02078.
- Non-destructive testing in accordance with Section 02072.
- Destructive testing (field testing) in accordance with Section 02072.

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

NOT USED.

END OF SECTION

SECTION 01520
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Electricity, Lighting.

B. Water.

C. Sanitary Facilities.

D. Barriers.

E. Protection of Work.

F. Security.

G. Cleaning During Construction.

H. Field Offices and Sheds.

I. Removal.

1.2 ELECTRICITY, LIGHTING

A. Provide service disconnect and electrical feeder from existing service to field office. Take measures to conserve energy. OWNER will pay for energy used.

1.3 WATER

A. Provide water for construction operations. Water for construction and dust control is available on site.

1.4 SANITARY FACILITIES

A. Provide and maintain enclosed, portable, self-contained sanitary facilities.

1.5 BARRIERS

A. Provide as required for OWNER's use of site, to prevent public entry to construction areas and to protect existing facilities and adjacent properties from damage.

1.6 PROTECTION OF WORK

A. Provide temporary protection for Work in progress and items installed.

B. Control traffic in construction area to minimize damage to completed Work.

1.7 SECURITY

A. Provide security program and facilities to protect Work, existing facilities, and OWNER's operations from unauthorized entry, vandalism and theft. Coordinate with OWNER's security program.

1.8 CLEANING DURING CONSTRUCTION

A. Control accumulation of waste materials and rubbish; periodically dispose of off-site.

B. Maintain site in a clean and orderly condition.

C. Clean interior plant areas at the end of each day's Work; control dust and other contaminants during operations.

1.9 FIELD OFFICES AND SHEDS

A. Office: Weather-tight, equipped with lighting, electrical outlets, heating, cooling, and ventilating equipment, and furniture. Provide separate private office including these items listed above for use of ENGINEER.

B. Storage Sheds for Tools, Materials and Equipment: Weather-tight, with adequate space for organized storage and access, and lighting for inspection of stored materials.

1.10 REMOVAL

A. Remove temporary materials, equipment, services, and construction prior to final inspection.

B. Restore existing facilities used during construction to specified, or to original, condition.

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

NOT USED.

END OF SECTION

SECTION 01570
TEMPORARY CONTROLS

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Dust Control.

B. Erosion and Sediment Control.

C. Noise Control.

D. Pollution Control.

1.2 DUST CONTROL

A. Execute Work by methods to minimize raising dust from construction operations.

B. Schedule construction operations so that the least area is disturbed at one time.

C. Leave undisturbed buffer areas between graded areas wherever possible.

D. Install temporary or permanent surface stabilization measures immediately after completing land grading.

E. Employ the following methods of dust control when practical:

- **Vegetative cover** – For disturbed areas not subject to traffic.
- **Mulch** (including gravel mulch)
- **Spray-on adhesive** – Examples of spray-on adhesives for use on mineral soils:

	Water Dilution	**Type of Nozzle**	**Apply Gallons/Acre**
Anionic asphalt emulsion	7:1	Coarse spray	1,200
Latex emulsion	12.5:1	Fine spray	235
Resin in water	4:1	Fine spray	300

- **Calcium chloride** may be applied by mechanical spreader as loose, dry granules or flakes at a rate that keeps the surface moist, but not so high as to cause water pollution or plant damage.

- **Sprinkling** – The site may be sprinkled until the surface is wet. Sprinkling is especially effective for dust control on haul roads and other traffic routes.

- **Stone** used to stabilize construction roads.

- **Barriers** – A board fence, wind fence, sediment fence, or similar barrier can control air currents and blowing soil. Place barriers perpendicular to prevailing air currents at intervals about 15 times the barrier height. Where dust is a known problem, preserve windbreak vegetation.

- **Tillage** – Deep plow large open undisturbed areas and bring clods to the surface. This is a temporary emergency measure that can be used as soon as soil blowing starts. Begin plowing on the windward edge of the site.

1.3 EROSION AND SEDIMENT CONTROL

A. Minimize amount of bare soil exposed at one time.

B. Plan and execute construction to control surface drainage from cuts and fills, and from borrow and waste disposal areas. Prevent erosion and sedimentation.

C. Keep duration of exposure of construction materials before final finishing or cover as short as practical.

D. Conduct operations to avoid washing or deposition of materials into waterways or off-site.

E. Do not track or spill mud, clay, gravel, or other materials onto adjacent streets or off-site. Clean off inadvertent tracking and spills immediately.

F. Periodically inspect earthwork for evidence of erosion and sedimentation; promptly apply corrective measures.

1.4 NOISE CONTROL

A. Limit the operation of heavy equipment and machinery to the hours of 7:00 a.m. to 7:00 p.m. Additional hours must be approved by OWNER.

1.5 POLLUTION CONTROL

A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances and pollutants produced by construction operations.

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

NOT USED.

END OF SECTION

SECTION 01574
TEMPORARY WATER CONTROL

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Control of surface water and ground water during construction.

1.2 WATER CONTROL

A. Rough grade site to prevent standing water and to direct surface water drainage away from Work area.

B. Maintain or relocate existing ditches and spillways.

C. Do not stockpile material such that it restricts surface drainage.

D. If it is necessary to interrupt existing surface water drainage, provide and maintain temporary piping or ditching until permanent drainage is provided.

E. Maintain excavations and trenches free of water. Provide and operate pumping equipment of a capacity to control water flow out of excavations and trenches.

F. Provide piping to handle discharge to prevent erosion or deposit of silt. Remove equipment when no longer needed for temporary water control.

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

NOT USED.

END OF SECTION

SECTION 01600
MATERIAL AND EQUIPMENT

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Transportation and Handling.

C. Storage and Protection.

D. Disposal.

E. Product Options.

F. Products List.

G. Substitutions.

H. Systems Demonstration.

1.2 PRODUCTS

A. Products include material, equipment, and systems. Products may also include existing materials or components required for reuse.

B. Do not use materials and equipment removed from existing structure or system, except as specifically required, or allowed by Contract Documents.

C. Comply with Specifications and referenced standards as minimum requirements.

D. Provide components of the same manufacturer, for interchangeable components.

1.3 TRANSPORTATION AND HANDLING

A. Transport products by methods which prevent product damage; deliver in undamaged, dry condition in manufacturer's unopened containers or packing.

B. Provide equipment and personnel to handle products by methods which prevent soiling or damage.

C. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

1.4 STORAGE AND PROTECTION

A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.

B. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to prevent condensation.

C. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.

D. Arrange storage to provide access for inspection. Periodically inspect to ensure products are undamaged, and are maintained under required conditions.

1.5 DISPOSAL

A. Submit to ENGINEER the disposal site location for excess materials which may not be disposed on-site before beginning Work.

B. Dispose of excess materials off-site in an appropriate manner.

1.6 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description only: Any product meeting those standards may be used.

B. Products Specified by Naming one or more Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not specifically named.

C. Products Specified by Naming Several Manufacturers: Products of named manufacturers meeting specifications: No options, no substitutions allowed.

D. Products Specified by Naming Only One Manufacturer: No options, no substitutions allowed.

1.7 PRODUCTS LIST

A. Within 15 days after Notice to Proceed, submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

1.8 SUBSTITUTIONS

A. ENGINEER will consider CONTRACTOR's request for substitutions only within 15 days after Notice to Proceed. Subsequently, substitutions will be considered only when a product becomes unavailable through no fault of CONTRACTOR.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

C. Request constitutes a representation that CONTRACTOR:

1. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product.

2. Will provide the same warranty for substitution as for the specified product.

3. Will coordinate installation and make other changes which may be required for Work to be complete in all respects.

4. Waives claims for additional costs which may subsequently become apparent.

D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals without separate written request, or when acceptance will require substantial revision of Contract Documents.

E. ENGINEER will determine acceptability of proposed substitution, and will notify CONTRACTOR of acceptance or rejection in writing within a reasonable time.

F. Only one request for substitution will be considered for each product. When substitution is not accepted, provide specified product.

1.9 SYSTEMS DEMONSTRATION

A. Prior to final walk-through demonstrate operation of each system to ENGINEER and OWNER.

B. Instruct OWNER's personnel in operation, adjustment, and maintenance of equipment and systems, using the operation and maintenance data as the basis of instruction.

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

NOT USED.

END OF SECTION

SECTION 01720
FIELD ENGINEERING

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Submittals.

B. Quality Assurance.

C. Surveying and Field Engineering Services.

D. CONTRACTOR Survey Requirements.

1.2 SUBMITTALS

A. On request, submit data demonstrating qualifications of persons providing services.

B. On request, submit documentation verifying accuracy of survey Work.

C. Maintain complete, accurate log of control and survey Work as it progresses. Submit Record Documents under provisions of Section 01770.

1.3 QUALITY ASSURANCE

A. Use skilled persons, trained and experienced in the necessary tasks and techniques, for the proper performance of this Work.

B. Verify locations of survey control points prior to starting Work. Promptly notify ENGINEER of any discrepancies discovered.

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

3.1 SURVEYING AND FIELD ENGINEERING SERVICES

A. ENGINEER will identify a minimum of three benchmarks.

B. ENGINEER will document construction of the following items:

- Elevation of top of select ash fill.
- Invert elevations and location of PVC piping.
- Final cover thickness and elevation.

3.2 CONTRACTOR SURVEY REQUIREMENTS

A. Establish and maintain lines and levels.

B. Set lath on a 100-foot grid pattern for ENGINEER's use in documenting Work.

C. Locate and lay out Work by instrumentation and similar appropriate means.

D. Periodically verify layouts.

END OF SECTION

SECTION 01760
MONITORING WELL PROTECTION

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Protection

B. Repair

1.2 PROTECTION

A. Preserve and protect existing monitoring wells from damage.

B. Protect well casing and boring from infiltration of surface water, other water, soil, and any foreign materials.

C. Use hand equipment when excavating, filling, or conducting other operations around monitoring wells.

D. Notify ENGINEER of necessary alterations, necessary adjustments in heights, or damage to monitoring wells.

1.3 REPAIR

A. Monitoring well damaged by CONTRACTOR's operations will be repaired or replaced by a licensed well driller, as approved by the OWNER and at no cost to OWNER.

B. ENGINEER will observe the repaired well to determine if further repair or replacement is needed. Repair and replacement shall be done at no expense to OWNER.

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

NOT USED.

END OF SECTION

SECTION 01770
CONTRACT CLOSEOUT

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Closeout Procedures.

B. Final Cleaning.

C. Project Record Documents.

D. Warranties and Bonds.

1.2 CLOSEOUT PROCEDURES

A. Comply with procedures stated in General Conditions of the Contract for issuance of Certificate of Substantial Completion.

B. In addition to submittals required by Conditions of the Contract, provide submittals required by governing authorities, and submit a final statement of accounting giving total adjusted Contract Sum, previous payments, and sum remaining due.

1.3 FINAL CLEANING

A. Execute prior to final walk-through.

B. Clean sediment from drainage ditches, culverts, and sediment control systems.

1.4 PROJECT RECORD DOCUMENTS

A. Maintain on-site, one set of the following project record documents; record actual revisions of the Work:

1. Contract Drawings.

2. Specifications.

3. Addenda.

4. Change Orders and other Modifications to the contract.

5. Reviewed shop drawings, product data, and samples.

B. Store project record documents separately from construction documents.

C. Keep documents current; do not permanently conceal any Work until required information has been recorded.

D. At contract closeout, submit documents with transmittal letter containing date, Project title, CONTRACTOR's name and address, list of documents, and signature of CONTRACTOR.

1.5 WARRANTIES AND BONDS

A. Provide duplicate, notarized copies when specified in specific Section. Execute CONTRACTOR's submittals and assemble documents executed by subcontractors, suppliers, and manufacturers. Provide table of contents and assemble in binder with durable plastic cover.

B. Submit material before final application for payment. For equipment put into use with OWNER's permission during construction, submit within ten days after first operation.

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

NOT USED.

END OF SECTION

SECTION 02072
LINEAR LOW-DENSITY POLYETHYLENE (LLDPE) GEOMEMBRANE

PART 1. GENERAL

1.1 WORK INCLUDES

A. Providing linear low-density polyethylene (LLDPE) geomembrane (non-textured/textured) in accordance with the Drawings and these Specifications, including, but not limited to, deployment of geomembrane, seaming, repairs, testing, and necessary and incidental items required to complete the Work. Textured geomembrane will be installed on the terraces and steep sideslope. Textured or non-textured geomembrane can be used on the top slope (on slopes equal or less than 5 percent).

1.2 REFERENCE STANDARDS

A. ASTM D792 - Specific Gravity (Relative Density) and Density of Plastics by Displacement.

B. ASTM D1004 - Test Method for Initial Tear Resistance of Plastic Film and Sheeting.

C. ASTM D1238 - Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.

D. ASTM D1248 - Specification for Polyethylene Plastics Molding and Extrusion Materials.

E. ASTM D1505 - Test Method for Density of Plastics by the Density-Gradient Technique.

F. ASTM D1603 - Test Method for Carbon Black in Olefin Plastics.

G. ASTM D3895 - Test Method for Oxidative Induction Time of Polyolefins by Thermal Analysis.

H. ASTM D4218 - Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.

I. ASTM D4437 - Standard Test Methods for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes.

J. ASTM D4833 - Tech Method for Index Puncture Resistance Geotextiles, Geomembrane, and Related Products.

K. ASTM D5199 - Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes.

L. ASTM D5323 - Practice for Determination of 2% Secant Modulus for Polyethylene Geomembrane.

M. ASTM D5596 - Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics.

N. ASTM D5617 - Test Method for Multi-Axial Tension Test for Geosynthetics.

O. ASTM D5721 - Practice for Air-Oven Aging of Polyolefin Geomembranes.

P. ASTM D5885 - Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High Pressure Differential Scanning Calorimetry.

Q. ASTM D5994 - Test Method for Measuring the Core Thickness of Textured Geomembranes.

R. ASTM D6392 - Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.

S. ASTM D6693 - Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polyethylene Geomembranes.

T. GRI GM6 - Standard Practice for Pressurized Air Channel Test for Dual Seamed Geomembranes.

U. GRI GM12 - Measurement of Asperity Height of Textured Geomembrane Using a Depth Gauge.

V. GRI GM17 - Test Properties and Testing Frequency for Linear Low-Density Polyethylene (LLDPE) Smooth and Textured Geomembrane.

1.3 DEFINITIONS

A. Installer - CONTRACTOR or organization hired by CONTRACTOR to install the Geomembrane (and if applicable, other geosynthetic components).

B. Manufacturer - Company hired by CONTRACTOR to furnish geomembrane.

C. Resin Supplier - Company selected by the manufacturer to furnish polyethylene resin used to manufacture the geomembrane.

D. Geomembrane - A relatively impermeable thin sheet of polyethylene used as a barrier liner or cover to prevent liquid or vapor migration into or from liquid or solid storage facilities.

E. Textured Geomembrane - Geomembrane with roughened, high-friction surfaces created by co-extrusion, extrusion coating, or spray coating.

F. Installation Field Crew - Individuals employed by installer to deploy geomembrane panels and perform field-screening, nondestructive testing, and other critical operations.

G. Fusion Weld - A bond between two polyethylene geomembrane surfaces achieved by fusing both polyethylene surfaces into a homogeneous bond using a power-driven apparatus capable of heating and compressing the overlapped portions of the geomembrane sheets at a specified rate of speed.

H. Extrusion Weld - A bond between two polyethylene materials achieved by extruding a bead of molten polyethylene over leading edge of the seam between upper and lower sheet, or rigid polyethylene piping or plating, using a hand-held apparatus.

I. ENGINEER - Official representative of OWNER. ENGINEER or designated Construction Quality Control Officer (CQA Officer) is responsible for observing and documenting that activities related to quality assurance of the construction conform to the plans and specifications.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer: At least 5 years of continuous experience in manufacturing LLDPE geomembrane and have produced 10,000,000 square feet (minimum) of LLDPE geomembrane and installed at least 8,000,000 square feet.

2. Installer:

a. At least 5 years of continuous experience in installing polyethylene geomembranes and have installed a minimum of 10,000,000 square feet (minimum) of polyethylene geomembrane for at least 10 completed facilities.

b. Personnel performing seaming operations: Qualified by experience or by successfully passing seaming tests. At least one seamer to have experience in seaming 1,000,000 square feet (minimum) of polyethylene geomembrane using the same type of seaming apparatus to be used on this project. The most experienced seamer, called the "master seamer," to provide direct supervision, as required, over less experienced seamers.

B. Quality Assurance Program: Manufacturer/Installer agree to participate in and conform with Quality Assurance Program as outlined in this Specification and Construction Quality Assurance Plan.

1.5 SUBMITTALS

Items A through E shall be submitted no later than 30 days prior to start of geomembrane installation or 15 days prior to delivery of first geomembrane shipment, whichever is sooner.

A. Raw Materials:

1. Resin supplier name, production plant(s) location(s), and the resin brand name and product number.

2. Copy of quality control certificates issued by LLDPE resin suppliers.

3. LLDPE resin production date(s).

4. Results of tests conducted by manufacturer and resin supplier. Results shall conform with requirements in Part 2.2(A).

5. Statement by manufacturer certifying that no recycled polymer and no more than 10% rework of the same type of material is added to resin during geomembrane manufacturing.

B. Manufacturer's Certification: Manufacturer shall certify that supplied geomembrane meets manufacturer’s minimum specifications.

C. Geomembrane Manufacturer/Production Information:

1. List of geomembrane roll numbers proposed for the project and associated batch each roll was produced.

2. Quality control certificates for geomembrane rolls and welding rod indicating compliance with requirements of Part 2.

D. Geomembrane Installer's Information:

1. Corporate background information.

2. Construction Quality Control (CQC) Plan.

3. A list of at least 10 completed facilities, totaling 10,000,000 square feet minimum for which the Installer has completed installing polyethylene geomembrane. Include facility name, location, installation date, geomembrane type, and quantity installed.

4. List of field crew personnel, along with pertinent project experience information.

E. Installation panel layout diagram identifying placement of geomembrane panels and seams and variances or additional details that deviate from engineering drawings. Following approval, do not change the layout without permission from ENGINEER.

F. Submittals during installation:

1. Daily records/logs prepared by installer documenting the work performed (i.e., productivity), personnel involved, general working conditions, and any problems encountered or anticipated on the project.

2. Subgrade acceptance forms prepared by installer for each day geomembrane was deployed.

3. Quality control documentation (i.e., trial seam tests, destructive tests, nondestructive tests).

4. Field tensiometer calibration certificate.

G. Submittals after completion of installation:

1. Geomembrane installation certification stating the geomembrane was installed in accordance with the contract documents.

2. As-built panel layout diagram.

3. Warranty from manufacturer/installer

1.6 DELIVERY, STORAGE, AND HANDLING

A. Shipping: Ship geomembrane liner rolled onto cores that allow for easy handling and deployment.

B. Transportation: Unload and handle geomembrane rolls by appropriate means to prevent damage.

C. On-Site Storage: Provide on-site storage location for geomembrane material with level base that protects the geomembrane from punctures, abrasions, and excessive dirt and moisture.

D. On-Site Handling: Use appropriate handling equipment when moving geomembrane rolls. Instructions for moving shall be given by manufacturer.

1.7 WARRANTIES

A. Manufacturer/Installer shall provide written 2-year warranties from date of substantial completion. Warranties shall address quality of material and workmanship.

PART 2. PRODUCTS

2.1 MANUFACTURERS

A. LLDPE Geomembranes

Agru/America, Inc.
500 Garrison Road
Georgetown, SC 29440
1-800-321-1379

Poly-Flex, Inc.
2000 West Marshall Drive
Grand Prairie, TX 75051
1-888-765-9359

GSE, Lining Technology, Inc.
19103 Gundle Road
Houston, TX 77073
1-800-435-2008

B. Substitutions: Submit request to ENGINEER and OWNER with complete supporting technical information under provisions of Section 01600.

2.2 MATERIALS

A. Polyethylene Geomembrane Resin

1.	Specific Gravity/Density	ASTM D792, Method B or ASTM D1505	0.926 maximum
2.	Melt Index	ASTM D1238 (190°C & 2.16 kg)	1.0 g/10 minute maximum

3. Resin: Virgin material with no more than 10 percent rework (by weight). Rework material to be of the same formulation as parent material. No post-consumer resin allowed.

B. LLDPE Geomembrane

1. Manufactured from top quality resin.

2. No more than 1 percent (by weight) of additives, fillers, or extenders, excluding carbon black.

3. Free of holes and shall have no undispersed raw materials, striations, scratches, or blemishes on geomembrane surface.

4. Carbon black for ultraviolet protection, added during the manufacture of geomembrane.

5. Uniform non-textured/textured appearance.

C. Fabrication

1. Supply geomembrane in factory-produced rolls. No factory seams may be used to prepare larger geomembrane panels for delivery to the site.

2. Label each geomembrane roll with the following information:

- Name of manufacturer.
- Product type and identification number (if any).
- Nominal product thickness.
- Roll number and dimensions.

2.3 ACCEPTANCE TESTING REQUIREMENTS

Evaluate and test geomembrane rolls prior to acceptance. ENGINEER or a designated, independent geosynthetics laboratory may perform additional testing (i.e., conformance testing and direct shear testing) to verify that LLDPE geomembrane meets the specifications and project requirements. Testing requirements are detailed in following subsections:

A. Manufacturer's Quality Control Testing

Perform tests on LLDPE geomembrane at frequencies given in Tables 02072-1 and 02072-2 prior to shipping.

Submit test results to ENGINEER prior to shipping geomembrane rolls. ENGINEER will evaluate test results as discussed in Subsection 2.3(C).

B. Conformance Test Samples

Samples may be collected by a third-party geosynthetic laboratory at the geomembrane plant at the minimum rate specified in Subsection 8.2.1 of the CQA Plan.

Samples: 3 feet long by the full width of the roll and not the first 3 feet of any roll or as required by the third-party geosynthetic laboratory to perform required testing. Tables 02072-1 and 02072-2 lists conformance tests and test methods that may be performed on geomembrane roll samples. ENGINEER will perform testing through use of a recognized testing laboratory. ENGINEER will evaluate test results as discussed in Subsection 2.3(C).

MANUFACTURER shall not ship geomembrane rolls to the site until test results have been evaluated by ENGINEER and accepted for shipment.

OWNER will bear the cost for conformance testing. The cost for retesting samples required due to failing test results shall be paid by CONTRACTOR.

Table 02072-1
Linear Low Density Polyethylene (LLDPE) Geomembrane – Non-Textured

PROPERTIES	TEST METHOD	TEST VALUE (40 mils)	TESTING FREQUENCY (minimum)
Thickness - mils (min. average) ▪ Lowest individual of 10 values	D5199	nom. -10%	Per roll
Density g/mL (max.)	D1505/D792	0.939	200,000 lb
Tensile Properties (min. average)(1) ▪ Break strength - lb/in ▪ Break elongation - %	D6693 Type IV	 152 800	20,000 lb
2% Modulus - lb/in (max.)	D5323	2,400	Per formulation
Tear Resistance - lb (min. average)	D1004	22	45,000 lb
Puncture Resistance - lb (min. average)	D4833	56	45,000 lb
Axi-Symmetric Break Resistance Strain - % (min.)	D5617	30	Per formulation
Carbon Black Content - %	D1603(2)	2.0-3.0	45,000 lb
Carbon Black Dispersion	D5596	Note (3)	45,000 lb
Oxidative Induction Time (OIT) (min. average)(4) ▪ Standard OIT —or— ▪ High Pressure OIT	 D3895 D5885	 100 400	200,000 lb
Oven Aging at 85°C(5) ▪ Standard OIT (min. average) - % retained after 90 days —or— ▪ High Pressure OIT (min. average) - % retained after 90 days	D5721 D3895 D5885	 35 60	Per formulation
UV Resistance(6) ▪ Standard OIT (min. average) —or— ▪ High Pressure OIT (min. average) - % retained after 1,600 hours(8)	 D3895 D5885	 N.R.(7) 35	Per formulation

Notes:

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.

— Break elongation is calculated using a gauge length of 2.0 inches at 2.0 in/min.

(2) Other methods such as D4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.

(3) Carbon black dispersion (only near spherical agglomerates) for 10 different views:

— Nine in Categories 1 or 2, and 1 in Category 3.

(4) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(5) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90-day response.

(6) The condition of the test should be 20-hour UV cycle at 75°C, followed by 4-hour condensation at 60°C.

(7) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.

(8) UV resistance is based on percent retained value regardless of the original HP-OIT value.

Table 02072-2
Linear Low Density Polyethylene (LLDPE) Geomembrane - Textured

PROPERTIES	TEST METHOD	TEST VALUE (40 mils)	TESTING FREQUENCY (minimum)
Thickness mils (min. average) ▪ Lowest individual for 8 out of 10 values ▪ Lowest individual for any of the 10 values	D5994	nom. (-5%) -10% -15%	Per roll
Asperity Height mils (min. average)(1)	GM 12	10	Every 2nd roll(2)
Density g/ml (max.)	D1505/D792	0.939	200,000 lb
Tensile Properties (min. average)(3) ▪ Break strength - lb/in ▪ Break elongation - %	D6693 Type IV	 60 250	20,000 lb
2% Modulus - lb/in (max.)	D5323	2,400	Per formulation
Tear Resistance - lb (min. average)	D1004	22	45,000 lb
Puncture Resistance - lb (min. average)	D4833	44	45,000 lb
Axi-Symmetric Break Resistance Strain - % (min.)	D5617	30	Per formulation
Carbon Black Content - %	D1603(4)	2.0-3.0	45,000 lb
Carbon Black Dispersion	D5596	Note (5)	45,000 lb
Oxidative Induction Time (OIT) (min. average)(6) ▪ Standard OIT —or— ▪ High Pressure OIT	 D3895 D5885	 100 400	200,000 lb
Oven Aging at 85°C(7) ▪ Standard OIT (min. average) - % retained after 90 days —or— ▪ High Pressure OIT (min. average) - % retained after 90 days	D5721 D3895 D5885	 35 60	Per formulation
UV Resistance(8) ▪ Standard OIT (min. average) —or— ▪ High Pressure OIT (min. average) - % retained after 1,600 hours(10)	 D3895 D5885	 N.R. (9) 35	Per formulation

Notes:
(1) Of 10 readings, 8 out of 10 must be ≥ 7 mils, and lowest individual reading must be ≥ 5 mils; also see Note 9.
(2) Alternate the measurement side for double-sided textured sheet.
(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction.
— Break elongation is calculated using a gauge length of 2.0 inches at 2.0 in/min.
(4) Other methods such as D4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.
(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views:
— Nine in Categories 1 or 2, and 1 in Category 3.
(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90-day response.
(8) The condition of the test should be 20-hour UV cycle at 75°C, followed by 4-hour condensation at 60°C.
(9) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.

C. Procedures for Determining Geomembrane Roll Test Failures

Tables 02072-1 and 02072-2 lists the acceptance Specifications. For tests results reported in both machine and cross direction, compare results from each direction to listed Specifications to determine acceptance. For test methods requiring multiple specimens, criteria in Tables 02072-1 and 02072-2 must be met based on average results of multiple specimen tests. Use the following procedures for interpreting results:

1. If the test result values meet stated Specifications, then roll and batch, and entire shipment, if applicable, will be accepted based on conformance testing; and

2. If test results do not meet Specifications, then roll and batch must be retested at CONTRACTOR's expense using specimens from the original roll sample or from another sample collected by ENGINEER or a third-party geosynthetics laboratory. For retesting, perform two additional tests for a failed test procedure.

   If both retest values meet Specifications, then roll and batch will be accepted based on conformance testing; if one additional test fails, then roll and batch must be rejected without further recourse. ENGINEER may obtain samples from other rolls in batch. On the basis of testing these samples, ENGINEER may choose to accept a portion of batch while rejecting the remainder.

   If retesting does not result in passing test results as defined above, or if there is any other nonconformity with the material Specifications, then geomembrane rolls must be withdrawn from the site. Do not resubmit these same rolls for use. Remove rejected geomembrane from the site and replace with acceptable geomembrane.

D. Direct Shear Testing and Stability Analysis

Identify the proposed geomembrane manufacturer, GCL manufacturer, and geocomposite drainage layer manufacturer a minimum of 4 weeks prior to the start of geomembrane installation to allow ENGINEER to conduct direct shear testing on the selected geomembrane material.

Collect geomembrane samples for direct shear testing at Manufacturer's plant as directed by ENGINEER. Collect samples of on-site soil/material for direct shear testing as directed by ENGINEER. ENGINEER will perform the required testing through the use of a recognized geosynthetic testing laboratory. OWNER will bear the cost for direct shear testing.

The following interfaces may be direct shear tested:

- Select ash vs. GCL
- GCL vs. geomembrane
- Geomembrane vs. geocomposite
- Geocomposite vs. general fill

ENGINEER will perform slope stability calculations using the direct shear test results on materials proposed for construction. ENGINEER will determine if the proposed geomembrane will be acceptable or unacceptable based on the evaluation of the stability analysis.

PART 3. EXECUTION

3.1 EARTHWORK PREPARATION

A. Prepare foundation and complete subgrade surface that will support geomembrane. Excavate, backfill, and compact the anchor trenches to dimensions and at locations shown on Drawings.

B. Prior to geomembrane deployment, visually examine subgrade surface to confirm suitability for deployment of geomembrane thereon. Verify that subgrade is firm, smooth, and uniform; and free of excessive moisture, abrupt changes in grade, cracking, protruding stones and clay clods (greater than 1 inch), vegetation, and other deleterious debris. Refinish subgrade surface found to be unsuitable for deployment of the geomembrane. Provide ENGINEER with written acceptance of the subgrade surface over which panels are to be deployed for each day of panel deployment.

C. Deploy geomembrane over prepared and acceptable subgrade surface as soon as practicable after the subgrade has been completed and is suitable for deployment of geomembrane.

3.2 INSTALLATION - PANEL DEPLOYMENT

A. Install geomembrane according to approved layout drawing. Notify ENGINEER of revisions or modifications to approved plan prior to installing the geomembrane. Upon placement, identify each panel by roll number, panel number, and date deployed.

B. Do not place geomembrane during precipitation, in areas of ponded water, or during excessive winds. ENGINEER may order the suspension of work during such conditions. GCL must be covered or protected from moisture by the end of each day.

C. Maintain documentation of above conditions in the daily installation records, and provide such documentation to ENGINEER. Inform ENGINEER if above conditions are not met.

D. Verify the following:

1. Equipment does not damage geomembrane.

2. Prepared surface underlying geomembrane has not deteriorated since previous acceptance, and is still acceptable at time of geomembrane placement.

3. Personnel working on geomembrane do not smoke, wear damaging footwear or clothing, or engage in activities that could damage the geomembrane.

4. Methods and equipment used to unroll and seam the geomembrane do not cause scratches, crimps, or gouges in the geomembrane.

5. Method used to place the rolls minimizes wrinkles (especially wrinkles between adjacent panels).

6. Adequate temporary loading or anchoring (continuously placed, if necessary) does not damage geomembrane.

7. No vehicular traffic operates directly over geomembrane, except for balloon-tire all-terrain vehicles (ATVs) when approved by ENGINEER.

Immediately notify ENGINEER if these conditions are, or have been, violated, and take immediate steps to mitigate any damage.

E. Examine each roll for damage after placement and prior to seaming. Inform ENGINEER as to which rolls, or portions of rolls, should be rejected or repaired. Mark and remove from site damaged rolls or portions of rolls that have been rejected, at no risk, or expense to OWNER. Notify ENGINEER when such removal occurs.

3.3 INSTALLATION - FIELD SEAMS

A. Seam Layout:

1. Orient seams parallel to the line of maximum slope. Do not orient seams across slopes steeper than 5:1 (horizontal to vertical). Minimize the number of seams in corners and at other odd-shaped geometric intersections.

2. Do not locate any horizontal seams on slopes steeper than 5:1 (horizontal to vertical).

3. Use a seam numbering system comparable to, and compatible with, the geomembrane panel numbering system.

B. Seaming Processes/Equipment

1. Use the approved processes for field seaming (welding), which are extrusion welds and dual hot wedge fusion welds. Other processes require written authorization from ENGINEER. Dual hot fusion weld all linear seams where possible. Fusion-weld corners, butt seams, and long repairs where possible.

2. Comply with the following requirements regarding use, availability, and cleaning of <u>extrusion welding</u> equipment:

a. Equip welding apparatus with operational thermocouples to continuously monitor temperature in barrel and at nozzle.

b. Clean and purge the extruder prior to beginning seaming until heat-degraded extrudate has been removed from the barrel.

c. Check vital mechanical components, i.e. teflon shoes, brushes, and thermostats, daily.

d. Place electric generator for equipment on a smooth base such that no damage occurs to the geomembrane.

e. Place a smooth insulating plate or fabric beneath hot equipment after usage to protect geomembrane.

3. Comply with the following requirements regarding use, availability, and cleaning of <u>dual hot wedge fusion welding</u> equipment:

a. Equip welding apparatus to continuously monitor applicable temperatures. Verify and document temperatures daily.

b. Ground edge of cross seams to a smooth incline (top and bottom) prior to welding. Patch cross seams after welding.

c. Place electric generator for equipment on a smooth base such that no damage occurs to the geomembrane.

d. Place a smooth insulating plate or fabric beneath hot equipment after usage to protect geomembrane.

C. Seaming Requirements/Procedures

1. Perform geomembrane seaming under the following weather conditions only:

a. Ambient temperatures of at least 32°F (0°C), but no higher than 104°F (40°C) unless authorized in writing by ENGINEER. Measure temperatures 1 to 2 feet above the geomembrane surface using a conventional mercury thermometer. Between ambient temperature of 32°F (0°C) and 50°F (10°C) seaming will be performed only if the geomembrane is preheated by either sun or hot air device.

b. Dry geomembrane.

c. No ponded water has collected above or below the surface of the geomembrane.

2. For seaming at ambient temperatures below 32°F or above 104°F, demonstrate to ENGINEER that the methods and techniques used to perform the seaming produce seams that are entirely equivalent to seams produced at temperatures above 50°F and below 104°F, and that the overall quality of the geomembrane is not adversely affected. ENGINEER may, at his/her sole discretion, deny approval for use of proposed technique regardless of demonstration results.

3. For overlapping and temporary bonding, use the following procedures:

a. Provide sufficient overlap between geomembrane panels to perform extrusion or fusion welding, in accordance with manufacturer's recommendation, and allow peel tests to be performed on the seam. Cap seam if there is insufficient overlap.

b. Do not use solvents or adhesives on geomembranes unless the product has been approved in writing by ENGINEER based upon samples and data sheets submitted to ENGINEER for testing and evaluation.

c. Do not use procedures to temporarily bond adjacent geomembrane rolls that will damage the geomembrane; in particular, control the nozzle temperature of the spot welding apparatus to protect the geomembrane from potential damage. Keep spot welding to a minimum. Spot welding is subject to weather restrictions listed above. Perform spot welding only by approved seaming personnel pursuant to Subsection 1.4 of this specification.

4. Make trial seams on nondeployed geomembrane seams at the beginning of each seaming period and at least once every 4 hours during continuous operation with each welding machine by each seaming technician performing geomembrane welding with that machine. Make trial seams under the same conditions as actual seams. Trial seams are also required for welding equipment for which the power supply has been interrupted. Seaming personnel must make at least one satisfactory trial seam each day to demonstrate satisfactory abilities. Satisfactory trial seams must pass the inspection and testing described below.

    a. Ensure that the trial seam samples are at least 3 feet long by 1 foot wide after seaming, with the seam centered along its length.

    b. Inspect trial seams for proper squeeze-out, footprint pressure, and general appearance. If general appearance is acceptable, then cut two specimens, 1 inch in width, from each end of the trial seam sample. Give remainder of trial seam to ENGINEER.

    c. Subject one specimen to a shear test and three specimens to a peel test (fusion welds shall be tested for peel on both sides of the air channel). If test specimens exhibit a film-tear bond and meet acceptance specifications listed in Subsection 3.5 Table 02072-3, then the trial seam is satisfactory.

    d. If trial seam fails the field test or inspection, make a second trial seam (either with or without adjustments in the seaming techniques), and inspect and test it. If no inspection or test on the second trial seam fails, then the trial seam is satisfactory. If the second trial seam fails, then adjust the seaming apparatus or seaming technique as necessary until two consecutive, satisfactory trial seams are obtained.

5. Seam Preparation:

    a. Ensure that the seam area is clean and free of moisture, dust, dirt, debris, and foreign material prior to seaming.

    b. Align seams so as to minimize the number of wrinkles and "fishmouths."

    c. If seam overlap grinding is required, complete grinding process according to manufacturer's instructions within one (1) hour of seaming operation. Do not damage geomembrane or cause excessive striation on geomembrane surface when grinding.

6. General Seaming Procedures:

    a. Use dual hot wedge fusion welding for linear seams.

    b. Use fusion welding for corner seams, butt seams, and long repairs where possible.

c. Extend welded seam to the end of geomembrane panels placed in anchor trenches to minimize the potential for tear propagation along the seam.

d. Whenever possible, start field seaming from top of slope down, to minimize the development of wrinkles. Use hot air only when making tack welds; no double-sided tape, glue, or other method is permitted.

e. Ensure that the completed liner does not exhibit "bridging" or "trampolining" when protective cover or other materials are placed over geomembrane.

f. “Walk out” fishmouths or wrinkles at seam overlaps if possible, or cut along ridge of wrinkle in order to achieve a flat overlap, and then weld along overlap and patch each end.

g. Provide adequate illumination when seaming operations are to be conducted at night.

h. When restarting an extrusion seam, grind end of existing extrusion bead, and start new seam with less than a 2-inch overlap of existing bead.

3.4 NONDESTRUCTIVE TESTING

A. Nondestructively test each field seam over its full length using one of the methods described in this section. Perform nondestructive testing concurrently with seaming and do not await completion of the project's seaming. Air pressure testing is only applicable to dual hot wedge fusion seams. Conduct vacuum box testing on dual wedge fusion seams with the airspace between the tracks open to the atmosphere at one or both ends of the seam.

B. Vacuum Box Testing

1. Vacuum box testing equipment:

a. Vacuum box with open bottom, clear viewing panel on top, and pliable gasket attached to the bottom.

b. Vacuum pump assembly equipped with pressure controller and pipe connections capable of achieving a vacuum of 8 psig.

c. Vacuum gauge on vacuum box with an operating range of vacuum pressures from 0 to 10 psig.

d. Soapy solution compatible with the geomembrane and conductive to the formation of bubbles with a means to apply.

2. Vacuum box test procedures:

a. Ensure that seams are clean and relatively free from soil or foreign objects.

b. Wet seam approximately twice the length of the vacuum box with a soapy solution.

c. Center vacuum box with gasket in contact with the geomembrane surface over the wetted area of the seam.

d. Apply normal force to the top of the vacuum box, Energize vacuum pump, and create a minimum vacuum in vacuum box of 5 to 10 psig. (Ensure that a tight seal is created between the geomembrane and vacuum box.)

e. Examine the geomembrane seam through the viewing panel for bubbles for a period of not less than 10 seconds.

f. Remove the vacuum box after removing or bleeding vacuum from the vacuum box. Proceed to step g if bubbles appeared in step e. If no bubbles appeared in step e, move vacuum box over the next adjoining area with a minimum 3-inch overlap, and repeat the process.

g. If bubbles appeared through the geomembrane, then mark the defective area with an appropriate device for repair according to the provisions of Subsection 3.6(C).

C. Air Pressure Testing

1. Air pressure testing equipment:

a. Air compressor with pressure gauge and regulator capable of producing and sustaining a pressure between 25 and 30 psig.

b. Fittings, rubber hose, valves, etc., to operate the equipment and a sharp hollow needle, or other pressure feed device, if approved by ENGINEER.

2. Air pressure testing procedures:

a. Seal both ends of the seam to be tested.

b. Insert needle into air channel of dual hot wedge seam.

c. Inflate airspace with compressor to a pressure of approximately 30 psig, close valve, and monitor pressure in the air channel for approximately 7 minutes.

d. Record pressure at the end of 2 minutes and again at the end of 7 minutes.

e. If the pressure difference between the 2-minute and the 7-minute readings exceeds 2 psi, or if the pressure does not stabilize within the 7-minute period, one more 5-minute pressure monitoring interval will be allowed.

f. If the pressure loss over both 5-minute intervals exceeds 2 psig or if the pressure does not stabilize, then the seam fails the test.

g. If the pressure loss over either 5-minute interval does not exceed 2 psig, then the seam may be deemed by the installer to have passed the test.

h. Cut the end of the tested seam interval opposite the pressure gauge to verify that air channel tested was not obstructed by noting a release of air pressure.

3. For seam intervals failing the air pressure nondestructive test, perform additional nondestructive testing or visual inspection to identify, if possible, the faulty area of the seam. Repair and retest the faulty area. If the faulty area cannot be identified, then repair and retest the entire seam.

D. Nondestructive Seam Test Failures

Repair seams failing nondestructive testing according to Subsection 3.6(C) and subsequently nondestructively retest according to Subsection 3.4.

3.5 DESTRUCTIVE TESTING

ENGINEER, under agreement with OWNER, will contract to have the seam samples laboratory-tested at OWNER's expense. Installer to perform field destructive seam testing.

A. Location and Sampling Frequency

1. ENGINEER will select locations where laboratory seam samples shall be cut by installer for destructive testing.

2. Collect laboratory destructive samples at a frequency of not less than one per every 500 linear feet of seam length. ENGINEER may direct that additional samples be cut.

B. Sampling Procedure

1. For each sample location, ENGINEER will:

a. Assign a sample number and mark accordingly.

b. Record sample location on layout drawing.

c. Record pertinent information, including date, time, number of seaming unit, and name of seamer.

2. Ensure that destructive samples are at least 12 inches wide (at least 5 inches on each side of the seam) by 42 inches long. Cut samples into three parts, and distribute as follows:

a. Cut and retain a 12-inch by 12-inch portion. Perform field testing on this sample as described in Subsection 3.5(C).

b. Cut a 12-inch by 12-inch portion and give it to ENGINEER for record storage.

c. Give the remaining 18-inch by 12-inch portion, to ENGINEER for testing as described in Subsection 3.5(D).

3. Repair holes cut into the geomembrane resulting from destructive seam sampling in accordance with Subsection 3.6(C). Nondestructively test repair area in accordance with Subsection 3.4(B).

C. Field Testing

1. Field-test a minimum of three 1-inch–wide samples for peel, and field-test a minimum of one 1-inch–wide samples for shear. Use a field tensiometer run at a cross-head speed of 20 inches per minute.

2. Record quantitative and qualitative test results, and evaluate against acceptance specifications listed in Table 02072-3.

3. Implement the procedures of Subsection 3.5(E) if any sample fails the field tensiometer test.

D. Laboratory Testing

1. Test destructive seam samples in general accordance with the methodology of ASTM D4437. Perform peel testing for dual hot wedge fusion welds on both inside and outside tracks.

2. Perform the following tests on each destructive seam sample:

   a. Shear strength, expressed in pounds per inch width (ppi), when tested in general accordance with ASTM D4437.

   b. Peel strength, expressed in pounds per inch width (ppi), recorded during the peel test in general accordance with ASTM D4437.

3. Ensure that the shear test gauge length is 2 inches between each edge of the seam and the adjacent grip. Maintain crosshead speed of 20 inches per minute. Monitor load and cross-head displacement during the test.

4. Ensure that peel test grips are no closer than 1 inch to the edge of the seam unless material is insufficient to allow insertion at this setting. Maintain cross-head speed of 20 inches per minute.

5. Report the following values, along with mean and standard deviation where appropriate for each specimen tested in shear:

   a. Maximum tension in pounds per square inch.

   b. Elongation at break (up to a tested maximum of 100 percent).

   c. The locus of failure.

Table 02072-3
40-mil LLDPE Geomembrane Acceptance Specifications

PROPERTY	TEST METHOD	UNITS	MINIMUM AVERAGE VALUE	
			Non-Textured	Textured[1]
Shear Strength[2]	ASTM D4437	ppi	60	60
Shear Elongation[2][6]	--	percent	50	50
Peel Strength[3],[4] - Fusion	ASTM D4437	ppi	50	50
Peel Strength[3],[4] - Extrusion	ASTM D4437	ppi	44	44
Peel Separation[5]	--	percent	25	25

NOTES:

(1) If the lengthwise edges of the textured geomembrane panels are nontextured, then the nontextured specifications shall apply for the testing of seams made along these edges. For textured to nontextured seams, use the textured specifications.

(2) Five out of the five test specimens shall meet these requirements. In addition, failure type must be film-tear bond (FTB) for all five specimens.

(3) Five out of the five specimens shall meet the three requirements.

(4) Failure type shall be film-tear bond (FTB) for five out of five test specimens.

(5) Maximum Acceptance Value for five out of five test specimens. The locus-of-break patterns of the different seaming methods in shear and peel, the following are unacceptable break codes per their description in ASTM D6392 (in this regard, SIP is an acceptable break code):

- Hot Wedge: AD and AD-BrK >25%.
- Extrusion Fillet: AD1, AD2, and AD-WLD (unless strength is achieved).

(6) Elongation measurements shall be omitted for field testing.

6. Report the following values, along with mean and standard deviation where appropriate for each specimen tested in peel:

   a. Maximum tension in pounds per square inch.

   b. Seam separation (expressed as percent of original seam area).

   c. Locus of failure.

7. Retesting of seams, because of failure to meet any or all of the specifications, may be performed at the sole discretion of ENGINEER.

E. Destructive Seam Test Failure

1. Evaluate results from the shear and peel tests against the criteria tabulated in Table 02072-3. Meet Table 02072-3 criteria for the seam to be considered acceptable.

2. Determine the repair boundary whenever a seam has failed the destructive testing following one of two options:

   a. Reconstruct the seam path between any two previously tested and passed field and laboratory destructive sample locations; or

   b. Trace the welding path to an intermediate location at least 10 feet from the point of the failed test in each direction, and obtain destructive test samples at these intermediate locations. If the destructive tests on these samples are acceptable, then reconstruct the seam between these intermediate locations. If either sample fails, then repeat the process until an acceptable seam test has been performed on both sides of the original failed sample. If a passing sample is not found on one (or both) sides of the original failed sample, then extend the seam repair to the end(s) of the seam. Continue to track the failing seam path, as necessary, and as appropriate, past the end(s) and onto the prior seams and following the seams made with the same welding equipment. For the retesting of seams, according to this procedure, use the sampling methodology described in Subsection 3.5(B). Continue tracking the seam path until passing field and laboratory destruction sample locations are found at both ends of the seam path, even if seaming occurred by the machine days prior or days after welding the failing destruct seam.

   An additional sample taken from the reconstructed seam must pass destructive seam testing, if destructive sample failure(s) causes the reconstruction and the length of the reconstructed seam is greater than 50 feet.

3.6 DEFECTS AND REPAIRS

A. Examine seam and nonseam areas of the geomembrane to identify defects, holes, blisters, undispersed raw materials, and signs of contamination by foreign matter. Clean surface of the geomembrane at the time of examination. Groom and wash geomembrane surface if the amount of dust or mud inhibits examination. Provide a water truck, an operator, and water and hoses as reasonably necessary to assist in such washing.

B. Evaluation

1. Mark each location requiring repair due to failure of the nondestructive test, observations, examinations, or destructive tests.

2. Do not cover locations that have been repaired or replaced until these locations are examined by ENGINEER and testing results indicate passing values.

C. Repair or replace portions of the geomembrane exhibiting a flaw, or failing a destructive or nondestructive test. Several procedures exist for the repair of these areas, as follows:

1. Patching—for repair of large holes, tears, undispersed raw materials, contamination by foreign matter, holes resulting from destructive sampling, and locations where the seam overlap is insufficient.

2. Spot welding or seaming—for repair of small tears, pinholes, or other minor, localized flaws.

3. Capping—for repair of large lengths of failed seams.

4. Removal and replacement—used to replace nonconforming or damaged panels or portions thereof.

5. Additional procedures if agreed upon by ENGINEER.

D. Extend patches and caps at least 6 inches beyond the edge of the defect. Round the corners of patches and caps. In addition, satisfy the following provisions:

1. Abrade surfaces of the geomembrane to be repaired no more than 1 hour prior to the repair if extrusion welding techniques are used.

2. Ensure that geomembrane surfaces are clean and dry at the time of repair.

3. ENGINEER must approve repair procedures, equipment, materials, and techniques prior to the repair.

E. Log the repair date, time, welder number, and the name of welder operator for each repair. Nondestructively test each repair. Passing tests indicate adequate repair. Large caps may be of sufficient extent to require destructive test sampling at the discretion of ENGINEER.

F. If failing nondestructive tests indicate inadequate repair, reconstruct repair and retest until a passing result is obtained.

G. Cut and seam wrinkles that are higher than they are wide or may adversely affect the long-term integrity of the geomembrane, hinder subsequent construction of the overlying layers, or impede drainage off the geomembrane after it is covered by soil. Perform seaming in accordance with the equipment and procedures described in Subsections 3.3(B) and 3.3(C), respectively, and subject to the test provisions of Subsections 3.4 (nondestructive testing) and 3.5 (destructive testing).

3.7 MATERIAL IN CONTACT WITH GEOMEMBRANES

A. Pipe Penetrations and Appurtenances - Verify that the following requirements are met:

1. Non-destructively test seaming performed on and pipe penetrations, and other appurtenances according to one of the following methods: (1) vacuum box method as discussed in Section 3.4; (2) spark testing according to manufacturer's recommended procedures.

2. The geomembrane has not been visibly damaged while making connection to sumps and appurtenances.

3. Installation of the geomembrane in the area of the pipe penetrations and connections of the geomembrane to these structures and appurtenances have been made according to the approved engineering plans and shop drawings.

B. Soil - Requirements for the placement of soil are described in Section 02230. Apply the following general criteria for Work on geomembranes:

1. Do not place soil on the geomembrane at an ambient temperature below 32°F, (0°C) nor above 104°F (40°C), unless otherwise approved by ENGINEER.

2. Do not drive equipment used for placing the soil directly on the geomembrane.

3. A minimum thickness of 1 foot of soil is specified between a low ground pressure dozer (maximum contact pressure of 5 psi) and the geomembrane.

4. A minimum thickness of 2.0 feet of soil is specified between for other tracked vehicles and flotation-tire–equipped vehicles.

5. A minimum thickness of 3.0 feet of soil is specified between rubber-tired vehicles and the geomembrane, including areas of heavy traffic.

6. On slopes steeper than 6:1, place overlying soil from bottom to top.

C. Requirements for installation of the drainage Geocomposite and GCL are described in Sections 02078 and 2075, respectively.

END OF SECTION

SECTION 02075
GEOSYNTHETIC CLAY LINER

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Provide Geosynthetic Clay Liner (GCL), labor, materials, tools, supervision, transportation, and installation equipment necessary for the installation of the GCL in accordance with the Drawings and the Specifications, including, but not limited to, GCL panel layout, seaming, patching, testing, and all necessary and incidental items required to complete the work.

1.2 REFERENCE STANDARDS

A. GRI GCL3 – Test Methods, Required properties, and Testing Frequencies of Geosynthetic Clay Liners (GCLs)

B. GRI GCL2 - Permeability of Geosynthetic Clay Liners.

C. ASTM D5321 - Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.

D. ASTM D5887 - Test Method for Measurement of Index Flux through Geosynthetic Clay Liner Specimens using Flexible Wall Permeameter.

E. ASTM D5888 - Practice for Storage and Handling of Geosynthetic Clay Liners.

F. ASTM D5890 - Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners.

G. ASTM D5891 - Test Method for Fluid Loss of Clay Component of Geosynthetic Clay Liners.

H. ASTM D5993 - Test Method for Measuring the Mass per Unit Area of Geosynthetic Clay Liners.

I. ASTM D6102 – Standard Guide for Installation of Geosynthetic Clay Liners

J. ASTM D6141 – Standard Guide for Screening Clay Portion of Geosynthetic Clay Liner (GCL) for Chemical Compatibility to Liquids.

K. ASTM D6243 – Standard Test Method for Determining the Internal and Interface Shear Resistance of Geosynthetic Clay Liner by the Direct Shear Method.

L. ASTM D6496 – Standard Test Method for Determining Average Bonding Peel Strength Between Top and Bottom Layers of Needle-Punched Geosynthetic Clay Liners

M. ASTM D6768 – Standard Test Method for Tensile Strength of Geosynthetic Clay Liners

N. ASTM E946 - Standard Test Method for Water Absorption of Bentonite by Porous Plate Method.

1.3 DEFINITIONS

A. INSTALLER - Organization hired by CONTRACTOR to install the GCL (and if applicable other geosynthetic components).

B. MANUFACTURER - Company hired by CONTRACTOR to provide the GCL.

C. ENGINEER - Official representative of OWNER. ENGINEER or designated Construction Quality Assurance Officer (CQA Officer) will be responsible for observing and documenting that activities related to the quality assurance of the construction conform to the Plans and Specifications.

D. Installation field crew - Group of individuals employed by INSTALLER to coordinate deployment of GCL panels, and to perform field seaming and other critical operations.

E. Geosynthetic Clay Liner - Factory-manufactured hydraulic barriers typically consisting of bentonite clay or other very low–permeability clay materials, supported by geotextiles and/or geomembranes, which are held together by needling, stitching, and/or chemical adhesives.

1.4 QUALITY ASSURANCE

A. Qualifications

1. MANUFACTURER shall have at least 3 years of continuous experience in the manufacturing of GCLs and shall have produced a minimum of 10,000,000 square feet of needle punched GCL with at least 8,000,000 square feet installed.

2. INSTALLER shall have at least 3 years of continuous experience in the installation of GCLs and shall have installed a minimum of 1,000,000 square feet of GCL for at least 5 completed facilities, or must provide to ENGINEER satisfactory evidence, through similar experience in the installation of other types of geosynthetics, that the GCL will be installed in a competent, professional manner.

B. Manufacturer's Quality Control Plan (MQCP) - The manufacturer of each component of the GCL and the GCL itself shall have an established MQCP to ensure that their product meets all of the stated minimum properties.

1.5 MANUFACTURERS' QUALITY CONTROL PLANS (MQCP)

A. Bentonite Supplier

1. The bentonite supplier shall have a MQCP that is adhered to in the bentonite manufacturing process. This plan shall include, at a minimum, the following provisions:

a. Testing or procedures to verify that the bentonite is sodium bentonite

b. Testing or procedures to verify that the bentonite meets specified gradation requirements

c. Testing or procedures to verify that the bentonite meets specified index test requirements

d. Testing or procedures to verify that the bentonite has not been treated with synthetic chemicals or polymers

B. Geotextile Supplier

1. The geotextile supplier shall have a MQCP that is adhered to in the geotextile manufacturing process. This plan shall include, at a minimum, the following provisions:

a. Certification that the material is needle free and consists of nonwoven polyester or polypropylene fiber material.

b. Certification that the material meets certain minimum average roll values

C. GCL Manufacturer

1. MANUFACTURER shall have a MQCP that describes the procedures for accomplishing quality in the final product. At a minimum, the tests shown in Table 02075 shall be performed by MANUFACTURER (or an independent laboratory hired by MANUFACTURER).

2. The MQCP shall also dictate that

a. overlap alignment lines are to be marked along the roll edges;

b. completed rolls are to be securely wrapped in plastic;

c. completed rolls are to be stored indoors, and provisions are to be in place to prevent rolls from being stacked too high, damaged during handling, and from becoming wet;

d. Quality Control certificates shall be provided for each GCL roll.

1.6 SUBMITTALS

A. Submittals prior to shipment and installation

1. GCL Manufacturer/Production Information:

a. Corporate background information.

b. MQCPs for bentonite, geotextile, and GCL Manufacturers.

c. Project reference list consisting of the principal details of at least 10 projects totaling at least 8 million square feet of GCL installation.

d. Test results conducted by the bentonite supplier and geotextile supplier to document the quality of the materials used to manufacture the GCL rolls assigned to this project.

Table 02075
GCL Material Tests, Test Methods, and Acceptance Specifications

	Property	Test Method	Units	Value
Bentonite properties	Free swell Fluid loss	ASTM D5890 ASTM D5891	mL/2g mL	24 (MARV)[1] (min) 18 (max)
Hydraulic properties	Flux [2],[3]	ASTM 5887	m^3/m^{2-S}	1×10^{-8} (max)
Physical GCL properties	Bentonite mass per unit area	ASTM D5993	lb/sqf	0.75 (MARV)[1] (min)
GCL properties	Tensile strength Peel strength	ASTM D6768 ASTM D6496	lb/in lb/in	23 (min) 2.1 (min)

NOTES:

(1) Minimum average roll value (MARV).

(2) Flux is defined as "flow rate/unit area" which can be converted to permeability using the equation:

permeability = flux/hydraulic gradient

(3) Report results at a maximum confining stress of 34 Kpa (5 psi) and 14 Kpa (2 psi) head pressure.

f. Copy of quality control certificates, signed by a responsible entity of MANUFACTURER. Each quality control certificate shall include roll identification numbers, and the results of quality control tests.

g. MANUFACTURER'S written certification that the GCL meets the project specifications, that the GCL has continuously been inspected and found to be needle free, and that the bentonite will not shift during transportation or installation.

2. GCL INSTALLER Information:

a. Corporate background information.

b. Project reference list consisting of the principal details of at least 10 projects totaling at least 8 million square feet.

c. List of personnel performing field operations, along with pertinent experience information.

3. Proposed panel layout diagram identifying placement of GCL panels and seams, as well as any variance or additional details that deviate from engineering Drawings. Layout shall be drawn to scale and shall be adequate for use as a construction plan and shall include information such as dimensions and details.

4. Installation schedule as part of construction progress schedule.

B. Submittals during installation:

1. Daily records/logs prepared by INSTALLER documenting work performed, personnel involved, general working conditions, and any problems encountered or anticipated on the project, to be submitted at a minimum, on a weekly basis.

2. Copy of subgrade acceptance forms by INSTALLER.

3. Quality control documentation.

C. Submittals after completion of installation:

1. Installation Certification certifying that the GCL was installed in accordance with the plans and specifications and the CQA Plan.

2. As-built panel layout diagram identifying the placement of panels and seams. The numbering sequence shall be agreed upon between ENGINEER and INSTALLER prior to commencing installation.

3. Copy of warranty obtained from MANUFACTURER/INSTALLER.

1.7 DELIVERY, STORAGE, AND HANDLING

The manufacturer assumes responsibility for initial loading the GCL. Shipping will be the responsibility of the party paying the freight. Unloading, on-site handling and storage of the GCL are the responsibility of the Contractor, Installer or other designated party.

A. Delivery: Deliver all GCL rolls to the job site at least 3 weeks prior to installation to allow for conformance testing unless approval to deliver later than 3 weeks prior to installation is approved by ENGINEER.

B. Transportation:

1. Inspect each roll as it is unloaded to identify if the packaging has been damaged. Rolls with damaged packaging shall be marked and set aside for further inspection. Repair packaging before being placed in storage.

2. The party responsible for unloading the GCL should contact the Manufacturer prior to shipment to ascertain the appropriateness of the proposed unloading methods and equipment.

C. On-Site Storage:

1. Storage of the GCL rolls shall be the responsibility of the installer. A dedicated storage area shall be selected at the job site that is away from high traffic areas and is level, dry and well drained.

2. Protect from direct sunlight, moisture, and heat.

3. Use wooden pallets for aboveground storage of the GCL rolls.

4. Use heavy waterproof tarps for protecting all GCL rolls and accessory bentonite.

5. Rolls should be stacked at a height no higher than that at which the lifting apparatus can be safely handled (typically no higher than four). Stacks or tiers of rolls should be situated in a manner that prevents sliding or rolling by “choking” the bottom layer of rolls. Rolls shall not be stacked on uneven or discontinuous surfaces in order to prevent bending, deformation, damage to the GCL or cause difficulty inserting the core pipe.

6. The integrity and legibility of the label shall be preserved during storage.

D. On-Site Handling:

1. Use appropriate handling equipment when moving rolls of GCL from one place to another. Provide instructions for moving.

2. Use a fork lift, front-end loader, crane, or other similar equipment. The selected piece of equipment shall not be used in a manner that will cause damage to the subgrade, such as rutting. Verify in the presence of ENGINEER that the selected piece of equipment does not damage the subgrade.

3. Use a spreader bar to prevent slings from damaging the ends of the rolls.

Insert a pipe, in accordance with manufacturer's recommendations, into the core of the roll for lifting.

1.8 WARRANTY

A. Provide written 5-year warranty from date of substantial completion. Warranty shall address quality of material and workmanship.

PART 2. PRODUCTS

2.1 MANUFACTURERS

A. Geosynthetic Clay Liners:

Colloid Environmental Technologies Company (CETCO)
2870 Forbs Avenue
Hoffman Estates, IL 60192
1-800-527-9948

GSE Lining Technology, Inc.
19103 Gundle Road
Houston, TX 77073
800-435-2008

B. Substitutions: Submit request to ENGINEER and OWNER with complete supporting technical information under provisions of Section 01600.

2.2 MATERIALS

A. The GCL shall meet the material specifications as shown in Table 02075 (CETCO Bentomat DN or equal) and the minimum requirements of the MQCP.

B. The GCL shall consist of a layer of pure sodium bentonite encapsulated between two 6-ounce minimum non-woven geotextiles which are needle-punched together, and comply with all of the manufacturing processes and physical/chemical criteria listed in this Section.

C. The bentonite utilized in the manufacture of the GCL, as well as any accessory bentonite provided for seaming and detail work, shall meet MANUFACTURER's minimum requirements, as specified in the MQCP.

D. The geotextile components of the GCL shall meet the minimum requirements of the MQCP.

E. Fabrication

1. GCL panels shall be supplied to the site in factory-produced rolls. MANUFACTURER shall supply GCL panels to the job site in standard factory roll dimensions.

2. Each roll of GCL supplied to the site shall be labeled with the following information:

   a. Name of manufacturer

   b. Product type and identification number (if any)

   c. Lot (Batch) number

   d. Date of manufacture

   e. Roll number and dimensions

2.3 ACCEPTANCE TESTING REQUIREMENTS

The GCL rolls shall be tested and evaluated prior to acceptance. In general, testing of the GCL shall be conducted by MANUFACTURER. ENGINEER or a designated, independent geosynthetics laboratory may perform additional testing (i.e., conformance testing), as required by these detailed Specifications or as required in the judgment of ENGINEER to verify that the GCL meets the specifications. Testing requirements are detailed in the following subsections:

A. Manufacturer's Quality Control Testing

Manufacturer is required to submit a Manufacturing Quality Control Plan, as discussed in Section 1.5. Test results shall be submitted to ENGINEER prior to shipping the rolls. ENGINEER shall evaluate the results as discussed in Section 2.3(D).

B. Conformance Test Samples

Samples may be collected by CONTRACTOR under the direction of ENGINEER at a rate of one sample per 100,000 square feet of GCL delivered to the site. Hydraulic conductivity test samples may be collected at a rate of one sample per 750,000 square feet of GCL delivered to the site. At least one sample may also be obtained from each GCL production batch in each shipment. Samples shall be at least 3 feet long by the full width of the roll and shall not include the first 3 feet of any roll.

Table 02075 lists the conformance tests and the test methods that may be performed on GCL roll samples. The Specifications and methods used in evaluating the conformance test results are discussed in Section 2.3(D).

C. Role of Testing Laboratories

CONTRACTOR shall be responsible for acquiring the samples described in Section 2.3(B) and for providing the samples to ENGINEER. ENGINEER will perform the required testing through the use of a recognized testing laboratory. OWNER will bear the cost for this conformance testing. Any costs for retesting of samples required due to test results not meeting the acceptance specification criteria shall be paid by CONTRACTOR.

D. Procedures for Determining GCL Roll Test Failures

Table 02075 lists the acceptance Specifications. For any referenced test method that requires the testing of multiple specimens, the criteria in Table 02075 shall be met based on the average results of the multiple specimen tests. The following procedure shall be used for interpreting results:

1. If the test result value meets the stated Specification, then the roll, the batch, and, if applicable, the entire shipment shall be considered to have passed this particular acceptance test.

2. If the result does not meet the Specification, then the roll and the batch shall be retested at CONTRACTOR's expense using specimens either from the original roll sample or from another sample collected by ENGINEER. For retesting, two additional tests shall be performed for the failed test procedure. (Each additional test shall consist of multiple specimen tests if multiple specimens are called for in the failed test procedure.) If both of the retests are acceptable, then the roll and batch shall be considered to have passed this particular acceptance test; if either of the two additional tests fail, then the roll and batch shall be considered unsuitable without further recourse. ENGINEER may obtain samples from other rolls in the batch. On the basis of testing these samples, ENGINEER may choose to accept a portion of the batch while rejecting the remainder.

   If retesting does not result in passing test results as defined in the preceding paragraph, or if there is any other nonconformity with the material Specifications, then CONTRACTOR shall withdraw the rolls from use in the project at CONTRACTOR's sole risk, cost, and expense. Once withdrawn, the same rolls shall not be resubmitted for use. Cost and expense for removing this GCL from the site and replacing it with acceptable GCL shall be the sole risk and responsibility of CONTRACTOR.

E. Steep Slopes

GCL will be direct shear tested (ASTM D6243). Refer to Section 02072, Subpart 2.3.D.

CONTRACTOR will identify the proposed GCL manufacturer a minimum of 4 weeks prior to the start of GCL installation to allow ENGINEER to conduct direct shear testing on selected GCL material.

GCL samples for direct shear testing will be collected at the Manufacturer's plant as directed by ENGINEER. ENGINEER will perform the required testing through the use of a recognized Geosynthetic testing laboratory. OWNER will bear the costs of these tests.

F. Chemical Compatibility

In linear applications, it may be necessary to determine the ability of the clay portion of a geosynthetic clay liner to resist change due to exposure to liquids, ASTM D 6141 should be followed.

PART 3. EXECUTION

3.1 SUBGRADE PREPARATION

A. Prepare the foundation and complete the subgrade surface that will support the GCL. Excavate and backfill anchor trenches as shown on the Drawings.

B. Prior to the deployment of the GCL, visually inspect the receiving subgrade surface to confirm that it is suitable for GCL deployment. The inspection shall verify that the subgrade is firm, smooth, and uniform; and that it is free of excessive moisture, abrupt changes in grade, cracks larger than one-quarter inch in width, large (greater than 0.5-inch) stones and clay clods, excessive rutting (greater than 1-inch), protrusions extending more than 0.5-inch, vegetation, and all other deleterious debris. If the

subgrade surface is found to be unsuitable for the GCL deployment, refinish the surface. Rolling the subgrade with a smooth-drum compactor is recommended. For each day of deployment, provide ENGINEER with written acceptance of the subgrade surface over which the panels will be deployed.

C. Deploy GCL over the subgrade surface as soon as practicable after the subgrade has been completed and deemed suitable for deployment.

3.2 INSTALLATION - PANEL DEPLOYMENT

A. Supply a panel layout drawing for approval by ENGINEER prior to construction. Install the GCL according to the layout drawing as approved. Notify ENGINEER of any revisions or modifications of the approved plan prior to installing the GCL in the area of the revision. Immediately upon placement, document the panel placement locations and identify each panel by roll number.

B. Do not place GCL during precipitation, in the presence of excessive moisture, in any area of ponded water, or during excessive winds. ENGINEER may order the suspension of work during such conditions. Failure to do so shall not be construed to relieve INSTALLER of the responsibility to meet this specification and properly perform the work, or the responsibility for personnel safety.

C. Place GCL over prepared surface to minimize material handling. Place proper side of GCL upward per manufacturer's recommendation or as specified by ENGINEER per direct shear testing results.

D. Maintain construction progress documentation in the daily installation records, and provide such documentation to ENGINEER. The documentation shall verify that the above conditions are fulfilled. Inform ENGINEER if any of the above conditions are not met.

E. Use sandbags to temporarily secure the GCL panels prior to placement of the overlying material. Cover material shall be placed over the GCL on the same day the GCL was deployed. Only install as much GCL that can be covered at the end of the day. No GCL shall be left exposed overnight. If the GCL is hydrated when no confining stress is present, it may be necessary to remove and replace the hydrated material.

F. Verify the following:

1. The equipment used does not damage the GCL by handling, excessive heat, leakage of hydrocarbons, or by other means.

2. The prepared surface underlying the GCL has not deteriorated since previous acceptance, and that it is still acceptable at the time of GCL placement.

3. Personnel working on the GCL do not smoke, wear damaging clothing, or engage in other activities that could damage the GCL.

4. The method used to unroll the GCL does not cause damage to the GCL, and/or the subgrade.

5. The method used to place the rolls minimizes wrinkles (especially wrinkles between adjacent panels).

Immediately notify ENGINEER if any of these conditions are being, or have been, violated, and take immediate steps to mitigate any damage.

6. Examine each roll for damage after placement and prior to seaming. Inform ENGINEER as to which rolls, or portions of rolls, should be rejected or repaired. Mark and remove from the site damaged rolls or portions of rolls that have been rejected , at no risk, cost, or expense to OWNER. Notify ENGINEER when such removal occurs.

G. GCL rolls should not be released on the slope and allowed to unroll freely by gravity.

H. Do not deploy when GCL is frozen.

I. If the GCL is prematurely hydrated greater than 30% moisture, installer shall notify the QA/QC technician and project engineer for a site specific determination as to whether the material is acceptable or if alternative measures must be taken to ensure the quality of the design.

3.3 INSTALLATION - PANEL SEAMING

A. Provide 6-inch to 9-inch overlap at longitudinal seam locations, and a minimum 24-inch overlap at the panel end seams. Use the line(s) printed on the panels to assist in obtaining this overlap. Adjust the edges of the GCL panels to smooth out any wrinkles, creases, or "fishmouths" to maximize contact with the underlying panel. Overlap seams such that the direction of flow is from the top panel to the underlying panel, to form a shingle effect.

B. After the overlying panel is placed, pull back its edge to expose the overlap zone. Remove any soil or debris present in the overlap zone or entrapped in the GCL or its individual components. Place a layer of granular bentonite in the overlap zone as per MANUFACTURER's recommendations (minimum application rate of one-quarter pound per linear foot).

C. Place granular bentonite or MASTIC grout around penetrations and structures as recommended by the GCL manufacturer or as shown on the Drawings.

3.4 DEFECTS AND REPAIRS

A. Examine and document all seam and non-seam areas of the GCL for identification of defects, holes, and any signs of contamination by any foreign matter. The surface of the GCL shall be clean at the time of examination.

B. Do not proceed with work with any materials that will cover locations that have been repaired or replaced until these locations are examined by ENGINEER.

C. Identify and repair any damage in the form of cuts or tears in the GCL by cutting a patch from unused GCL and placing it over the damaged area. Clear all dirt and debris from the damaged area. Extend the patch a minimum of 12 inches in all directions beyond the damaged area. Place a layer of granular bentonite in the overlap zone in accordance with MANUFACTURER's recommendations. It may be necessary to use an epoxy-based adhesive or alternative method of securing the patch as approved by ENGINEER to keep the patch in position during backfill operations.

D. Include documentation of defects and repairs in daily records/logs.

3.5 MATERIAL IN CONTACT WITH GEOSYNTHETIC CLAY LINER / COVER PLACEMENT

A. Geosynthetics - When covering the GCL with a geomembrane or other geosynthetic, take precautions to prevent damage to the GCL by restricting heavy equipment traffic. If a textured geomembrane is to be placed over the GCL, place a slip sheet (such as 20-mil smooth HDPE) over the GCL to allow the textured geomembrane to slide into its proper position. Remove slip sheet after geomembrane is in place.

B. Soil - Requirements for placement of soil are described in Section 02230. Apply the following general criteria for Work on GCLs:

1. Do not drive equipment used for placing the soil directly on the GCL.

2. A minimum thickness of 1 foot of soil is specified between a light dozer (i.e., maximum contact pressure of 5 lb/sq. inch) and the GCL.

3. A minimum thickness of 3 feet of soil is specified between rubber-tired vehicles and the GCL and frequently trafficked areas or roadways.

4. Care should be taken to avoid damaging the GCL by making sharp turns or pivots with equipment as well as sudden starts or stops.

C. When covering GCL on slope areas, cover soil will be pushed up-slope to minimize tension on the GCL. Soil cover will be placed in a manner that prevents the soil from entering GCL overlap zones.

D. Waterproof Sheet - Protect the leading edge of the GCL panels left uncovered at the end of the working day with a waterproof sheet that is adequately secured with sandbags or other ballast.

END OF SECTION

SECTION 02076
GEOTEXTILES

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Provide geotextile, labor, materials, tools, supervision, transportation, and installation equipment necessary for the installation of geotextile in the surface gas venting system, under road Aggregate Base Course, and under riprap, and geocushion in the lined channel, as specified herein, and as shown on the Drawings.

1.2 REFERENCES

A. ASTM D3786 - Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabric - Diaphragm Bursting Strength Tester Method.

B. ASTM D4491 - Standard Test Method for Water Permeability of Geotextiles by Permittivity.

C. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.

D. ASTM D4595 - Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.

E. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

F. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile.

G. ASTM D4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.

H. ASTM D5261 - Standard Test Method for Measuring Mass Per Unit Area of Geotextiles.

1.3 QUALITY ASSURANCE

A. Responsibilities and Qualifications:

1. Provide and accept and retain full responsibility for all services of a Geotextile Manufacturer and Installer who meet the following qualifications.

- Manufacturer: Shall be responsible for the production and delivery of geotextile rolls and shall be a well-established firm with more than 2 years experience in the manufacture of geotextiles. Shall submit a statement listing certified minimum average roll values of the proposed geotextile and the tests used to determine those properties.
- Installer: Shall be responsible for field handling, storing, deploying, seaming or connecting, anchoring, and other site aspects of the geotextiles. Shall be trained and qualified to install geotextiles.

B. Quality Assurance Program: Agree to participate in, and conform with, all items and requirements of the quality assurance program as outlined in this Specification.

1.4 SUBMITTALS

A. Submit the following information no later than 5 days prior to delivery of first shipment.

1. A copy of the quality control certificate for each roll of geotextile used. The quality control certificate shall include lot, batch, or roll numbers and identification.

2. The results of the quality control tests. The results shall include sampling frequencies and test methods used.

B. Manufacturer's Certification

On the basis of the results of the tests performed by either the Manufacturer’s laboratory or another outside laboratory with which Manufacturer has contracted at its sole cost and expense, Manufacturer shall provide a written certification that the supplied geotextile meets the requirements outlined in this Specification.

1.5 DELIVERY, STORAGE AND HANDLING

A. Unload and handle geotextiles so as to cause no damage.

B. Protect geotextiles from sunlight, moisture, mud, dirt, and dust, excessive heat or cold, puncture, or other damaging conditions.

C. Handle with care so as not to rupture or puncture geotextiles.

PART 2. PRODUCTS

2.1 MATERIALS

A. Geotextile shall consist of nonwoven polyester or polypropylene. Nonwoven fabric may be needle punched, heat bonded, resin bonded, or combinations thereof. Slit film woven fabric shall not be used for this work.

B. Unless otherwise noted on the Drawings, furnish materials with Minimum Average Roll Values (MARV) that meet or exceed the criteria specified in Tables 02076-1 and 02076-2. Provide test results for these procedures, as well as certification that the materials' properties meet or exceed the specified values.

C. Minimum Average Role Value (MARV) shall be based on Manufacturer's data and shall be calculated as the mean value of the property of interest plus or minus two standard deviations, as appropriate. Where material proprieties vary among the machine and cross-machine directions, the MARV shall apply to the direction providing the lowest value when a minimum value is specified or the highest value when a maximum value is specified.

Table 02076-1
Geotextile – Final Cover System and Under Riprap

Properties and Requirements	Qualifier	Units	Specified Values[1]	Test Method
Polymer composition	Minimum	Percent	95 percent polypropylene or polyester by weight	
Permittivity Apparent opening size (AOS)	Minimum Maximum	1/s Sieve	1.2 80	ASTM D4491 ASTM D4751
Grab strength[2] Break Elongation[2] Tear strength[2] Puncture strength[3] Burst strength	Minimum Minimum Minimum Minimum Minimum	lb Percent lb lb psi	200 50 85 130 400	ASTM D4632 ASTM D4632 ASTM D4533 ASTM D4833 ASTM D3786

Notes:

1 All values represent minimum average roll values (i.e., all rolls in a lot shall meet or exceed the values in this table).

2 Minimum value measured in machine and cross machine direction.

3 Tension testing machine with a 1.75-inch–diameter ring clamp, the steel ball being replaced with a 0.31-inch–diameter solid steel cylinder with a flat tip centered within the ring clamp.

Table 02076-2
Geocushion

Properties and Requirements	Qualifier	Units	Specified Values[1]	Test Method
Type	--	--	Nonwoven	--
Polymer composition	Minimum	Percent	95 percent polypropylene or polyester by weight	
Mass per unit area	Minimum	oz/yd^2	32	ASTM D5261
Grab strength[2] Tear strength[2] Puncture strength[3]	Minimum Minimum Minimum	lb lb lb	600 270 350	ASTM D4632 ASTM D4533 ASTM D4833

Notes:

[1] All values represent minimum average roll values (i.e., all rolls in a lot shall meet or exceed the values in this table).

[2] Minimum value measured in machine and cross machine direction.

2.2 ACCEPTANCE TESTING REQUIREMENTS

A. General Requirements: Geotextile rolls will be tested and evaluated prior to acceptance. In general, testing of the geotextile will be conducted by Manufacturer. ENGINEER or a designated, independent geosynthetics laboratory may perform additional testing (i.e., conformance testing) as determined necessary by ENGINEER to verify that the geotextile meets the specifications.

B. Manufacturing Quality Control

1. Sampling and testing of the geotextile material will be conducted by Manufacturer to demonstrate that the material conforms to the requirements in Part 2.1 of this Section. Submit test results in accordance with the submittal requirement of Part 1.4 of this Section and the CQA Plan.

2. Sampling shall, in general, be performed on sacrificial portions of the material, such that repair of the material is not required.

3. Samples that do not meet the specified properties shall result in rejection of the applicable rolls.

4. At Manufacturer's discretion and expense, additional testing of individual rolls may be performed to more closely identify the noncomplying rolls and/or to qualify individual rolls.

PART 3. EXECUTION

3.1 PREPARATION

A. Grade the area smooth; and remove all stones, roots, sticks, or other foreign material that would interfere with the geotextile being completely in contact with the soil prior to placing the geotextile.

3.2 HANDLING AND PLACEMENT

A. Handle all geotextiles in such a manner as to ensure they are not damaged in any way.

B. Take any necessary precautions to prevent damage to underlying layers during placement of the geotextile. After deployment of the geotextile, the geotextile shall not be left exposed for a period in excess of 20 days unless a longer exposure period is approved by ENGINEER, based on a formal demonstration by Manufacturer that the geotextile is stabilized against U.V. degradation for the proposed period of exposure.

C. Take care not to entrap stones, excessive dust, or moisture in the geotextile during placement.

D. Secure all geotextiles with sandbags, or equivalent. Such sandbags shall be installed during placement and shall remain until overlying protective soil cover or other components of the cover system are in place. Sandbags shall not be left in place without prior approval from ENGINEER.

E. Examine the entire geotextile surface after installation to ensure that no potentially harmful foreign objects are present. Remove any such foreign objects, and replace any damaged geotextile in accordance with Subsection 3.4.

F. Place all soil and geosynthetic materials on top of a geotextile as shown on the Drawings, in such a manner as to ensure that

1. the geotextile and underlying materials are not damaged;

2. minimum slippage occurs between the geotextile and underlying layers; and

3. excess stresses are not produced in the geotextile.

3.3 SEAMS AND OVERLAPS

A. Use Geocushion manufacturer's requirements for seaming and overlapping for geocushion installation.

B. Do not sew geotextiles. Overlap adjacent geotextile panels a minimum of 12 inches. No horizontal seams on slopes steeper than 10 horizontal to 1 vertical, except as part of a geotextile repair. Horizontal repair seams on such slopes will be sewn or thermally bonded.

C. For all sewing, use polymeric thread, with chemical resistance properties equal to or exceeding those of the geotextile.

3.4 REPAIR

A. Repair any holes or tears in the geotextile as follows:

1. On slopes steeper than 10 horizontal to 1 vertical, double-seam a patch made from the same geotextile into place (with each seam 0.5 inch apart and no closer than 2 inches from any edge) or thermally bonded. Should any tear exceed 10 percent of the width of the roll, remove that roll from the slope and replace it with new material.

2. On slopes flatter than or equal to 5 horizontal to one vertical, spot-seam a patch made from the same geotextile in place with a minimum of a 1-foot overlap in all directions.

B. Take care to remove any soil or other material that may have penetrated the torn geotextiles.

END OF SECTION

SECTION 02078
DRAINAGE GEOCOMPOSITE

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Provide geocomposite, labor, materials tools, supervision, transportation, and installation equipment necessary for the installation of geocomposite, as specified herein, and as shown on the Drawings, and in accordance with the Construction Quality Assurance (CQA) Plan.

1.2 Reference Standards

A. ASTM D413 - Standard Test Methods for Rubber Property - Adhesion to Flexible Substate.

B. ASTM D751 - Method of Testing Coated Fabrics.

C. ASTM D792 - Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

D. ASTM D1238 - Standard Test Method for Flow Rates of Thermoplastic by Extrusion Plastometer.

E. ASTM D1248 - Standard Specifications for Polyethylene Plastic Molding and Extrusion Materials.

F. ASTM 1505 - Test Method for Density of Plastics by the Density-Gradient Technique.

G. ASTM D1603 - Test Method for Carbon Black in Olefin Plastics.

H. ASTM D1777 - Standard Method for Thickness of Textile Materials.

I. ASTM D3776 - Test Method for Mass for Unit Area (Weight) of Woven Fabric.

J. ASTM D3786 - Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method.

K. ASTM D4355 - Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).

L. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

M. ASTM D4595 - Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip.

N. ASTM D4533 - Standard Test Method for Trapezoidal Tearing Strength of Geotextiles.

O. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

P. ASTM 4716 - Standard Test Method for Determining the (In-place) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.

Q. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile.

R. ASTM D4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembrane, and Related Products.

S. ASTM D4873 - Standard Guide for Identification, Storage, and Handling of Geotextiles.

T. ASTM D5035 – Standard Test Method for Breaking Force and Elongation of Testile Fabrics (Strip Method).

U. ASTM D5199 - Standard Test Method for Measuring Nominal Thickness for Geotextiles and Geomembranes.

V. ASTM D5261 – Standard Test Method for Measuring Mass Per Unit Area of Geotextiles.

W. ASTM 7005 – Standard Test Method for Determining the Bond Strength (Ply Adhesion) of Geocomposites.

X. ASTM F904 - Standard Test Method for Comparison of Bond Strength of Ply Adhesion of Similar Laminates Made From Flexible Materials.

1.3 QUALITY ASSURANCE

A. Qualifications and Responsibilities:

1. CONTRACTOR: Provide, accept, and retain full responsibility for all services of a Geonet Manufacturer and Installer who meet the following qualifications:

- MANUFACTURER: Provide references to ENGINEER indicating at least 3 years of continuous experience in the manufacturing of Geocomposite and have produced a minimum of 6,000,000 square feet of Geocomposite with at least 5,000,000 square feet installed. Submit a Manufacturer Quality control plan (MQCP) as described in Subsection 1.4. Submit a statement to ENGINEER indicating production capacity available and projected dates for delivery.
- INSTALLER: Provide references to ENGINEER indicating at least 5 years of continuous experience in the installation of Geocomposite and have installed a minimum of 1,000,000 square feet of Geocomposite for at least 10 completed facilities, or must provide to ENGINEER satisfactory evidence, through similar experience in the installation of other types of geosynthetics, that the geocomposite will be installed in a competent, professional manner.

  Be responsible for field handling, storing, deploying, seaming, and joining, temporary restraining (against wind), anchoring systems, and other site aspects or the geocomposite drainage layer.

B. Quality Assurance Program: Agree to participate in, and conform with, all items and requirements of the quality assurance program as outlined in this Specification (and in the Construction Quality Assurance CQA Plan.) Installation of the geocomposite shall be

monitored and all activities outlined in the CQA plan shall be accounted for in the installation schedule.

C. Quality Assurance:

1. Geocomposite shall be free of defects, rips, holes, and flaws.

2. It shall be manufactured in widths and lengths that will permit installation of geocomposite with as few laps as possible.

3. During shipment and storage, geocomposite shall be wrapped in relatively impermeable and opaque protective covers.

4. Geocomposite shall be marked with Manufacturer's name, product identification, lot number, roll number, and roll dimensions.

5. If any special handling is required, it shall be so marked on the geocomposite itself.

1.4 MANUFACTURERS' QUALITY CONTROL PLANS (MQCP)

A. Geonet Manufacturer - The Geonet Manufacturer shall have a MQCP that describe the procedures for accomplishing quality in the final product. Manufacturer shall sample and test the geonet and at a minimum, the test will demonstrate that the materials conform to the requirements shown in Table 02078 (test shall be performed by Manufacturer or an independent laboratory hired by Manufacturer).

B. Geotextile Supplier - The geotextile supplier shall have a MQCP that describes the products for accomplishing quality in the final product. The Manufacturer shall sample and test the geotextile and at a minimum, the test will demonstrate that the materials conform to the requirements shown in Table 02078 (test shall be performed by Manufacturer or independent laboratory hired by Manufacturer). This plan shall include the following provisions:

1. Certification that the material is made of specified polymeric material.

2. Certification that the material meets certain minimum average roll values

C. Geocomposite Manufacturer

1. Have a MQCP that describes the procedures for accomplishing quality in the final product. At a minimum, the tests shown in Table 02078 shall be performed by Manufacturer (or an independent laboratory hired by Manufacturer).

2. The geocomposite shall be manufactured with quality control procedures that meet or exceed generally accepted industry standards.

3. The MQCP shall also dictate that

   a. completed rolls are to be securely wrapped in plastic;

   b. completed rolls are to be stored indoors, and provisions are to be in place to prevent rolls from being stacked too high, damaged during handling, and from becoming wet; and

   c. Quality Control certificates shall be provided for each geocomposite roll.

Table 02078
Geocomposite Test and Acceptance Specifications

Property	Units	Value		Test	Criterion
		Top	Bottom		
Geotextile Properties					
Apparent opening size	Sieve	No. 70	No. 80	ASTM D4751	Minimum
Grab strength	Lb	160	220	ASTM D4632	Minimum
Trapezoidal tear	Lb	60	85	ASTM D4533	Minimum
Puncture strength	Lb	90	120	ASTM D4833	Minimum
Permittivity	gal/min/ft^2	110	95	ASTM D4491	Minimum
Property	**Units**	**Value**		**Test**	**Criterion**
Geonet Properties					
Thickness	mils	225		ASTM D1777	Minimum
Density	g/cc	0.93		ASTM D1505	Minimum
Melt flow index	g/10 min	1.0		ASTM D1238	Maximum
Carbon black content	percent	2 – 3		ASTM D1603	Range
Transmissivity	m^2/sec	1 x 10^{-5}		ASTM D4716	Minimum

Notes:

The geocomposite shall be manufactured by heat bonding an 8 oz/sy non-woven geotextile to the bottom of the geonet and a 6 oz/sy non-woven geotextile to the top of the geonet. No burn through geotextiles nor glue or adhesive shall be permitted.

The bond between the geotextile and the geonet shall exhibit a minimum peel strength of 1 pound per inch (ASTM D413).

The transmissivity (ASTM D4716) of the geonet shall be measured using a gradient of 0.1, water at 70°F, and normal load of 10,000 psf between steel plate for 15 minutes.

1.5 SUBMITTALS

A. Submittals to ENGINEER prior to shipment and installation

1. Geocomposite Manufacturer/Production Information:

   a. Corporate background information.

   b. MQCPs for geotextile/geonet manufacturers.

   c. Project reference list consisting of the principal details of at least 10 projects totaling at least 5 million square feet of geocomposite installation.

   d. Test results conducted by the geotextile/geonet supplier to document the quality of the materials used to manufacture the geocomposite rolls assigned to this project.

   e. Certification that no reclaimed polymer is added to the resin during manufacturer of the geocomposite drainage layers to be used in this project.

   f. Copy of quality control certificates for suppliers of the geotextile and geonet material used, and a quality control certificate issued by the resin supplier for the geonet including production dates of the resin, signed by a responsible entity of these Manufacturers. Each quality control certificate shall include product identification numbers, lot number, roll number, and the results of quality control tests, including descriptions of the test methods used.

   g. Geocomposite Manufacturer's written certification that the geocomposite meets the project specifications, that the geocomposite has continuously been inspected and found to be needle free. A quality control certification for each shift's production, signed by responsible parties employed by the manufacturer, and notarized. The certificate shall include roll numbers, sampling procedures; and results of quality control test, including method of test used.

2. GEOCOMPOSITE INSTALLER Information:

   a. Corporate background information

   b. Project reference list consisting of the principal details of at least 10 projects totaling at least 1 million square feet

   c. Submit written documentation to OWNER that the geocomposite has been installed according to the design plans and specifications and that in-place materials meet generally accepted standards of practice.

B. Submittals during installation:

1. Daily records/logs prepared by CONTRACTOR documenting work performed, personnel involved, general working conditions, and any problems encountered or anticipated on the project, to be submitted at a minimum, on a weekly basis

2. Quality control documentation

C. Submittals after completion of installation:

1. Installation Certification certifying that the geocomposite was installed in accordance with the plans and specifications and the CQA Plan.

2. Copy of warranty obtained from Manufacturer/Installer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Transportation of geocomposite is the responsibility of Manufacturer, who shall be liable for all damages to geocomposite/geonet prior to and during transportation to site.

B. Transportation: Unload and handle geocomposite rolls by appropriate means as recommended by Manufacturer so as to cause no damage. Inspect each roll as it is unloaded to identify if the packaging has been damaged. Rolls with damaged packaging shall be marked and set aside for further inspection. Repair packaging before being placed in storage.

C. On-Site Storage: Provide storage for the geocomposite at the site as recommended by Manufacturer. The geocomposite at a minimum shall be stored off the ground. Protect from direct sunlight, moisture, mud, dirt, debris, and excessive heat or cold.

D. On-Site Handling:

1. Use appropriate handling equipment when moving rolls of geocomposite from one place to another. Provide instructions for moving.

2. Handling, storage, and care of geocomposite on-site is the responsibility of CONTRACTOR prior to, during, and after geocomposite installation. OWNER shall provide adequate storage space on-site. CONTRACTOR shall be liable for all damages to geocomposite incurred prior to final acceptance of installation by OWNER, except for those due to negligent actions on part of OWNER.

1.7 WARRANTY

A. Provide written 2-year warranty from date of substantial completion. Warranty shall address quality of material and workmanship.

PART 2. PRODUCTS

2.1 MANUFACTURERS

A. Drainage Composite:

Agru America
500 Garrison Road
Georgetown, SC 29440
800-373-2478

GSE
19103 Gundle Road
Houston, TX 77073
800-435-2008

SKAPS Industries
335 Athena Drive
Athens, GA 30601
706-354-3700

Tenax Corporation
4800 East Monument Street
Baltimore, MD 21205
800-356-8495

B. Substitutions: Submit request to ENGINEER and OWNER with complete supporting technical information under provisions of Section 01600.

2.2 MATERIALS

A. The geocomposite shall meet the material specifications as shown in Table 02078 and the minimum requirements of the MQCP.

B. Geotextile: The geotextile portion of the geocomposite is to be comprised of polyester or polypropylene. Provide a nonwoven needle-punched geotextile for the geocomposite having the minimum average roll values given in Table 02078.

C. Geonet: Provide products for the geonet portion of the geocomposite to be comprised of HDPE. The geonet shall be manufactured by extruding two sets of stands to form a three dimensional structure to provide planer flow and shall meet the minimum average roll values given in Table 02078.

D. Fabrication:

1. Geocomposite panels shall be supplied to the site in factory-produced rolls. Manufacturer shall supply geocomposite panels to the job site in standard factory roll dimensions.

2. Each roll of geocomposite supplied to the site shall be labeled with the following information:

   a. Name of manufacturer
   b. Product type and identification number (if any)
   c. Lot (Batch) number

d. Date of manufacture
e. Roll number and dimensions

3. The geocomposite shall retain their structure during handling, placement, and long-term service.

4. Be capable of withstanding outdoor exposure for a minimum of 60 days with no measurable deterioration.

5. Be chemically inert when immersed in the leachate from a typical sanitary landfill.

2.3 Acceptance Testing Requirements

A. The geocomposite rolls shall be tested and evaluated prior to acceptance. In general, testing of the geocomposite shall be conducted by Manufacturer and a manufacturing quality control plan (MQCP), as discussed in Section 1.4, with test results shall be submitted to ENGINEER prior to shipping rolls. ENGINEER or a designated, independent geosynthetics laboratory may perform additional testing (i.e., conformance testing), as required by these detailed Specifications (see Table 02078) or as required in the judgment of ENGINEER to document that the geocomposite meets the specifications.

B. Conformance Testing:

1. Any geocomposite sample that does not comply with this specification shall result in rejection of the roll from which the sample was obtained. Replace any rejected rolls at no additional cost to OWNER.

2. If a geocomposite sample fails to meet the quality control requirements of this specification, CONTRACTOR shall require that the geocomposite Manufacturer sample and test each roll manufactured in the same lot or batch, or at the same time, as the failing roll. Sampling and testing of rolls shall continue until a pattern of acceptable test results is established.

3. Additional sample testing may be performed, at the geocomposite Manufacturer's discretion and expense, to more closely identify any non-complying rolls and/or to quality individual rolls.

4. Sampling shall, in general, be performed on sacrificial portions of the material such that repair of the materials is not required. The geocomposite Manufacturer shall sample and test the geocomposite to demonstrate that its properties conform to the values specified in Table 02078.

5. The geocomposite Manufacturer shall comply with the certification and submittal requirements of the CQA Plan.

PART 3. EXECUTION

3.1 Subgrade Preparation, Geocomposite Placement And Handling

A. Prepare the foundation layer (geomembrane component) that will support the geocomposite.

B. On slopes, anchor the top as shown on the drawings and then roll down the slope in such a manner as to continually keep the geocomposite in tension.

C. Prior to the deployment of the geocomposite, visually inspect the receiving geomembrane layer to confirm that it is suitable for geocomposite deployment. The inspection shall document that the geomembrane is firm, smooth, and uniform; and that it is free of stones and clay clods, vegetation, and all other deleterious debris. If the geomembrane surface is found to be unsuitable for the geocomposite deployment, refinish the surface. For each day of deployment, provide ENGINEER with written acceptance of the geomembrane surface over which the panels will be deployed.

D. Take any necessary precautions to prevent damage to underlying layers during placement of the geocomposite.

E. Handle all geocomposite in such a manner as to ensure it is not damaged in any way.

F. If necessary, the geocomposite shall be positioned by hand after being unrolled to minimize wrinkles.

G. In the presence of wind, geocomposite shall be weighted with sandbags or equivalent. Such sandbags shall be installed during placement and shall remain until replaced with cover material.

H. During placement, care shall be taken not to entrap any stones, excessive dust, or moisture that could cause clogging of the drainage system and/or stones that could damage the geomembrane.

I. Geocomposite shall be cut using Manufacturer's recommended procedures. If in place, special care must be taken to protect any geomembrane from damage which could be caused by cutting of geocomposites.

J. Examination of geocomposite over entire surface, after installation, shall be conducted to ensure that no potentially harmful foreign objectives, such as needles, are present. Any foreign objectives encountered shall be removed by CONTRACTOR, or geocomposite shall be replaced.

K. Geocomposite shall not be welded or tack welded to the underlying geomembrane liner.

L. The geocomposite placed on the sideslopes shall be placed with no horizontal seams along the slope. The geocomposite panels shall extend a minimum of 5 feet beyond the toe of slope as shown on the Drawings.

M. The geonet portion of the geocomposite shall be overlapped approximately 4 inches. The geonet shall be joined by colored plastic ties every 5 feet along the roll length and at panel ends.

N. Place the material located on top of geocomposite in such a manner as to ensure:

1. No damage of geocomposite

2. Minimal slippage of geocomposite on underlying layers.

3. No excess tensile stresses in geocomposite.

O. Unless otherwise specified by the ENGINEER, all equipment operating on soil material overlying the geocomposite shall comply with the Specification Section 02072, Subpart 3.7 B.3 through 6.

P. Deploy geocomposite over the geomembrane surface as soon as practicable after the geomembrane has been completed and deemed suitable for deployment.

3.2 Installation - Panel Deployment

A. Prior to beginning geocomposite installation, the Installer shall become thoroughly familiar with all portions of the work related to the geocomposite installation and the CQA Plan.

B. Prior to beginning geocomposite installation, the Installer shall inspect and document that all work is complete to the point where the installation of geocomposite may properly commence without any adverse impacts.

C. If CONTRACTOR has any concerns regarding the site preparation done prior to the installation, the Installer shall notify ENGINEER in writing within 48 hours of his site inspection. Failure to inform the ENGINEER in writing prior to installation of the geocomposite will construed as CONTRACTOR's acceptance of the site as ready for geocomposite installation.

D. Install the geocomposite according to the drawings as approved. Notify ENGINEER of any revisions or modifications of the approved plan prior to installing the geocomposite in the area of the revision.

E. Maintain construction progress documentation in the daily installation records, and provide such documentation to ENGINEER.

F. Use sandbags to temporarily secure the geocomposite panels prior to placement of the overlying material.

G. Document the following:

1. The equipment used does not damage the geocomposite by handling.

2. The prepared surface underlying the geocomposite has not deteriorated since previous acceptance, and that it is still acceptable at the time of geocomposite placement.

3. Personnel working on the geocomposite do wear damaging clothing, or engage in other activities that could damage the geocomposite.

4. The method used to unroll the geocomposite does not cause damage to the geocomposite, and/or the subgrade.

5. The method used to place the rolls minimizes wrinkles (especially wrinkles between adjacent panels).

Immediately notify ENGINEER if any of these conditions are being, or have been, violated, and take immediate steps to mitigate any damage.

H. Examine each roll for damage after placement and prior to connecting to adjacent panels. Inform ENGINEER as to which rolls, or portions of rolls, should be rejected or repaired. Mark and remove from the site damaged rolls or portions of rolls that have been rejected, at no risk, cost, or expense to OWNER. Notify ENGINEER when such removal occurs.

3.3 Installation - Panel Seaming

A. The geocomposite panels shall have no horizontal seams on slopes steeper than 5H:1V. On slope steeper than 5H:1V, continuous rolls shall be installed.

B. Continuously sew the upper geotextile of the geocomposite. Allow Construction Manager to document geonet is properly tied prior to sewing. The geotextile must be over lapped a minimum of 3 inches.

C. Adjust the edges of the geocomposite panels to smooth out any wrinkles, creases, or "fishmouths" to maximize contact with the underlying panel.

D. The geonet portion of the geocomposite panels shall overlap a minimum of 4 inches and fastening shall be with plastic fasteners or polymer braid. Fastening devices shall be white or yellow for easy inspection.

E. Fastening of the geonet portion of the geocomposite shall be every 5 feet along the slope, every 12 inches across the slope.

3.4 Defects And Repairs

A. Examine and document geocomposite for identification of damage, defects, holes, and any signs of contamination by any foreign matter. The surface of the geocomposite shall be clean at the time of examination.

B. Do not proceed with work with any materials that will cover locations that have been repaired or replaced until these locations are examined by ENGINEER.

C. Identify and repair any damage in the geocomposite by cutting a patch from unused geocomposite and placing it over the damaged area. Clear all dirt and debris from the damaged area. Extend the patch a minimum of 2 feet in all directions beyond the damaged area. Repair geonet portion of the geocomposite by securing the patch with connecting devices in accordance with Subsection 3.3(C) a minimum of 6 inches around the entire patch. Repair the geotextile portion of the geocomposite by thermally bonding the patch in place with a minimum of 24 inches overlap in all direction.

D. Include documentation of defects and repairs in daily records/logs.

3.5 Material in Contact with Geocomposite

A. Placement of soil Materials

1. Place all soil materials in such a manner as follows:

a. The geocomposite and underlying materials are not damaged;

b. Minimal slippage occurs between the geocomposite and underlying layers; and

c. Excess stresses are not produced in the geocomposite

2. Unless otherwise specified by ENGINEER, all equipment operation on soil material overlying the geocomposite shall comply with the following:

a. A minimum thickness of 1-foot of soil is specified between a low ground pressure dozer (maximum contact pressure of 5 psi) and the geocomposite.

b. A minimum thickness of 2.0-feet of soil is specified between for other tracked vehicles and flotation-tire-equipped vehicles.

c. A minimum thickness of 3.0-feet of soil is specified between rubber-tired vehicles and the geocomposite, including areas of heavy traffic.

END OF SECTION

SECTION 02232
CLEARING AND GRUBBING

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Clearing, stripping, grubbing, removing, and disposing of the trees, shrubs, brush, logs, stumps, roots, windfalls, and other plant life, including dead and decayed matter, that exists within the construction areas, borrow areas, and stockpile areas.

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

3.1 CLEARING AND GRUBBING

A. Remove trees, shrubs, brush, logs, stumps, and natural growth to location within the existing Borrow Area selected by the OWNER.

B. Remove stumps, roots, and logs to a minimum depth of 2 feet below ground surface.

3.2 DISPOSAL

A. Pile, clear, and grub debris at OWNER identified on-site location. OWNER will process the debris.

3.3 PROTECTION OF EXISTING TREES AND VEGETATION

A. Preserve and protect from damage trees and vegetation outside the Construction Limits.

B. Paint any cut or scarred trees and shrubs with asphaltum base tree paint.

END OF SECTION

SECTION 02315
EXCAVATION

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Digging, segregating, moving, and stockpiling of on-site clay, prepared subgrade fill, topsoil, and general fill, including finish grading to the extent and elevations shown on the Drawings.

B. Stripping, segregating, moving, and stockpiling soil at the borrow site. Finish grading of stockpiles.

C. Any work required to complete excavation operations required for this project.

D. Constructing perimeter drainage ditches and/or diversion berms for drainage.

E. Excavating and restoring the borrow site.

1.2 REFERENCE SECTION

A. OSHA 29 CFR Part 1926, Occupational Safety and Health Standards – Excavation

B. North Carolina Department of Transportation Standard Specifications for Roads and Structures, 1995 Edition, (NC DOT).

PART 2. PRODUCTS

NOT USED.

PART 3. EXECUTION

3.1 PREPARATION

A. Remove ice and snow before excavation.

B. Identify required construction survey control lines and datum.

C. Before beginning any Work specified in this section, ensure that all soil erosion and sediment control specifications are complied with and the proper state, county, or local authorities have been duly informed of the construction schedule. All erosion control features shall be installed prior to commencing earthwork operation and maintained throughout the duration of the Work.

3.2 PROTECTION

A. Notify all area utility companies (North Carolina 811) prior to commencing work in accordance with state and local regulations.

B. Locate, identify, and protect existing utilities from damage.

C. Protect benchmarks, survey monuments, monitoring wells, existing structures, fences and gates, sidewalks, paving, and curbs or any structure designated to remain from damage by excavation equipment and vehicular traffic.

D. Protect excavations by shoring, bracing, sheet piling, or other methods required to prevent cave-in or loose soil from falling into excavation.

E. Underpin adjacent structures, which may be damaged by excavation Work, including service utilities and piping.

F. Do not remove or disturb any materials outside the Construction Limits.

G. Provide and maintain proper drainage for the working area limits.

H. Keep excavations free from water by pumping or constructing diversion berms and/or ditches to divert water.

I. Protect and preserve or provide temporary services during Work if it is necessary to interrupt existing surface drainage or utilities.

J. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.

3.3 EXCAVATION

A. Grade perimeter of excavation to prevent surface water drainage into excavation.

B. Notify CONSTRUCTION MANAGER of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.

C. Identify material within the indicated borrow areas as select general fill, select prepared subgrade fill, select clay fill, topsoil, or unsuitable soils.

D. Stockpile excavated material in designated areas approved by the CONSTRUCTION MANAGER. Grade to provide positive drainage.

E. Remove unsuitable excess excavated material from the landfill site to a location approved by the OWNER.

F. Perform excavation of every description regardless of material encountered within the grading limits of the project to the line and grades indicated on the Drawings.

G. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet in excavations for structures, and extending a sufficient distance from the foundations to permit the placing and removal of concrete formwork, installation of services, other construction, and for inspection. In excavating for foundations, take care not to disturb the bottom of the excavation. Excavate by hand to the final grade just before the concrete reinforcement is placed.

H. Retain excavated materials removed from borrow operations and classified as unsuitable for select clay fill, select general fill, select prepared subgrade fill, or topsoil within the limits of the borrow area for use in the final grading of the borrow areas.

I. Utilize unsuitable soils encountered in excavating the borrow area to facilitate positive drainage and erosion control.

J. Transport excavated material suitable for its intended use and place in fill areas within limits of the work. In the event water is encountered during excavation, all necessary measures to control groundwater shall be implemented.

K. Strip and retain excavated material classified as topsoil to be spread as part of the revegetation operation of the exterior sideslopes and the borrow area.

L. Use excavated material classified as general fill in construction of embankments, or fills, and as backfill or similar purposes indicated on the Drawings. Excess excavated material suitable for general fill shall remain in the borrow area until used in the final grading operation or stockpiled for future use.

M. Use excavated materials classified as select clay fill for the construction of the liner in the sump area of the landfill. Excess material classified as select clay fill shall remain in the borrow area for future use.

N. Should excavations extend below design depths, backfill these excavations in accordance with this specification without extra cost to the OWNER.

3.4 FINISHING

A. Blend slopes with existing landscape features, at the intersection of cuts and fills; provide gradual slope between new and existing construction.

B. Finish to elevations shown within 0.10 foot tolerance.

END OF SECTION

SECTION 02317
TRENCHING, BACKFILLING, AND COMPACTION

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Excavating trenches, backfilling, and compacting for installation of piped utilities.

B. Dewatering, protection and maintenance of trench, support of existing structures, sheeting and shoring, hauling and disposal of excess excavated materials and fill.

1.2 REFERENCES

A. OSHA 29 CFR Part 1926, Occupational Safety and Health Standards - Excavations.

B. ASTM D698 – Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort: Standard Proctor.

C. North Carolina Department of Transportation, Standard Specifications for Roads and Structures, 1995 Edition (NC DOT).

1.3 SUBMITTALS

A. Comply with provisions of Section 01330.

PART 2. PRODUCTS

2.1 BACKFILL MATERIALS

A. Backfill: Select Fill complying with Section 02320.

2.2 BEDDING MATERIALS

A. Bedding material for the perforated HDPE gas venting system pipe shall be select aggregate fill, as specified in Section 02320 – Fill, and placed as shown on the Drawings.

PART 3. EXECUTION

3.1 PREPARATION AND RESTORATION

A. Remove sod, topsoil, gravel paving, and other surface treatment and restore to original condition or better upon completion of the Work.

3.2 PROTECTION

A. Protect excavations by shoring, bracing, sheet piling, or other methods required to prevent cave-in or loose soil from falling into excavation.

B. Place excavated and other material 2 feet minimum back from edge of trench excavation.

C. Underpin adjacent structures which may be damaged by excavation Work, including utilities and piping.

D. Notify CONSTRUCTION MANAGER immediately of unexpected subsurface conditions.

E. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.

F. All work shall be in compliance with local, state, and federal rules and regulations.

3.3 TRENCHING

A. Excavate to the required alignment and grade. Elevations of pipes subject to revisions as necessary to fit field conditions.

B. No adjustment in compensation will be made for grade adjustments not in excess of one foot above or below the plan elevations.

C. Maximum trench width at pipe level to be outside pipe diameter plus 24 inches.

D. Remove water which may accumulate in trench, and construct ditches, flumes, and dams to direct water away from excavation.

E. CONSTRUCTION MANAGER may limit the amount of open trench where field conditions or plant operations require.

F. CONSTRUCTION MANAGER may order additional excavation where unsuitable soil conditions are encountered.

G. Promptly dispose of excess excavation at on-site location designated by the CONSTRUCTION MANAGER.

H. Trenches for underground lines to be installed in waste material within the limits of the landfill shall be over excavated to at least 2 feet below the proposed elevation of the bottom of the pipe and backfilled as described below.

I. Wherever the grades are over excavated, refill all over excavated areas with compacted Select Aggregate Fill.

J. Trenches in fill areas shall be excavated after the fill has been placed and compacted to at least 2 feet above the proposed elevation of the top of pipe or conduit. Backfill shall be as specified above.

K. All trenching will be performed in accordance with OSHA requirements.

3.4 PIPE BEDDING

A. Minimum bedding requirements: Install bedding material as indicated on the plans.

B. Carefully prepare bedding so that the pipe after installation will be true to line and grade.

C. The bedding material beneath the pipe shall be graded to provide a uniform and continuous support beneath the pipe at all points between pipe joints.

D. After each pipe has been brought to grade, aligned, and placed in final position, deposit and compact sufficient bedding material under the pipe haunches and on each side of the pipe to hold the pipe in proper position during subsequent pipe jointing, bedding, and backfilling operations. Deposit bedding material uniformly in layers not exceeding 6 inches in compacted depth and simultaneously on each side of the pipe to prevent lateral displacement.

E. Mechanically compact bedding.

F. Compact pipe bedding to a minimum of 95 percent of maximum dry density as defined by ASTM D698.

3.5 BACKFILLING

A. Backfill immediately following completion of pipe installation.

B. Take necessary precautions with backfill and construction operations to protect completed utility system from damage.

C. Backfill with care around structures and cleanouts.

D. Backfill to the original ground elevation unless shown otherwise on Drawings.

3.6 COMPACTING

A. Compact backfills to at least 95 percent of the Standard Proctor (ASTM D698) maximum dry density in horizontal layers not exceeding 6 inches in thickness.

3.7 FIELD QUALITY CONTROL

A. Compaction testing will be performed under provisions of Section 02320.

B. Perform one compaction test for every 100 lineal feet of trench backfilled under provisions of Section 02320.

C. Backfill to within 0.10 feet of grades shown.

D. In the event that inadequate compaction is indicated, the backfill material shall be reworked until a passing test is obtained. All cost of the additional testing will be the responsibility of the CONTRACTOR.

END OF SECTION

SECTION 02320
FILL

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Moving or providing, placing, and compacting fill materials in accordance with the lines, grades, thicknesses, and typical sections shown on the Drawings.

1.2 REFERENCE STANDARDS

A. AASHTO Designation T96 - Percentage of Wear, Los Angeles abrasion test.

B. AASHTO Designation T104 - Sodium Sulfate soundness test, 5 cycles.

C. ASTM C136 - Test Method for Sieve Analysis of Fine and Coarse Aggregates.

D. ASTM D422 - Test Method for Particle-Size Analysis of Soils.

E. ASTM D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort: Standard Proctor.

F. ASTM D1140 - Standard Test Method for Amount of Material in Soils Finer than the No. 200 Sieve.

G. ASTM D1556 - Test Method for Density and Unit Weight of Soil In Place by the Sand-Cone Method.

H. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristic of Soil Using Modified Effort: Modified Proctor.

I. ASTM D2216 - Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock.

J. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).

K. ASTM D2487 - Classification of Soils for Engineering Purposes (Unified Soil Classification System).

L. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth).

M. ASTM D2937 - Standard Test Method for Density of Soil In Place by the Drive-Cylinder Method.

N. ASTM D3017 - Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

O. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

P. ASTM D4643 - Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method.

Q. ASTM D5084 - Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Material Using a Flexible Wall Permeameter.

1.3 SUBMITTALS

A. Comply with provisions of Section 01330.

B. Submit material testing documentation of select aggregate fill as described in Part 3 of this specification.

C. Compaction conditions require submittal of specific equipment proposed for use prior to intended field use:

1. Earth fills in open areas.

2. Earth fills in confined areas, such as trenches.

1.4 FIELD ENGINEERING

A. The CONTRACTOR shall establish all lines and grades necessary to accomplish the Work.

1.5 SCHEDULE

A. The CONTRACTOR shall examine the site and the plans thoroughly to determine the existing conditions and the difficulty of the Work to be performed and to establish a schedule for the grading operations. Schedule to be approved by OWNER.

PART 2. PRODUCTS

2.1 GENERAL FILL

A. Nonwaste material free from organic matter, frozen material, refuse, masonry, concrete, metal, sharp objects, demolition material, boulders, or any material designated as unsuitable shall be used for general fill material.

B. No solid material larger than 2 inches in its largest dimension.

C. General fill shall have a plasticity index of less than 30 and a maximum dry density of at least 90 pounds per cubic foot.

2.2 SELECT AGGREGATE FILL

A. North Carolina DOT No. 67 – Coarse Aggregate

SIEVE SIZE	% PASSING BY WEIGHT
1	100
¾	90-100
3/8	20-55
#4	0-10
#8	0-5

B. A minimum hydraulic conductivity of at least 1 cm/s at the dry density and moisture content achieved during placement.

C. Select Aggregate Fill for the perimeter drainage layer discharge and drainage bench shall be rounded to subangular. Select Aggregate Fill for the Surface Gas Venting System shall be rounded to subangular or crushed stone.

D. Select aggregate fill shall be furnished by the CONTRACTOR.

2.3 SELECT ASH FILL

A. Ash free of cinders and solid impurities capable of puncturing the GCL or geomembrane.

B. Select Ash Fill will be furnished by OWNER.

PART 3. EXECUTION

3.1 PROTECTION

A. Existing facilities, services, and pipelines, on, above, or under the surface of the area where earthwork operations are to be performed and which are not designated for abandonment, relocation or removal shall be protected from damage during construction operations. If such facilities are damaged, they shall be repaired to the satisfaction of the OWNER and at no expense to the OWNER.

B. All benchmarks, permanent monuments and property corners shall be protected from disturbance or destruction. Any such point disturbed or destroyed shall be immediately be replaced by qualified surveyors at no expense to the OWNER. Documentation of any such relocation shall be given to the OWNER.

C. Protect from any movement, damage, or settlement all existing or new construction, utilities, piping, monitoring wells, conduit, or any other structure designated to remain. Provide bracing, sheeting, shoring, underpinning, or other retaining structures necessary to provide proper protection.

D. Filling operations shall be performed in a manner and sequence that will provide adequate drainage at all times. When required, provide temporary drains, ditches, pumps, drainage lines, or other equipment to intercept, divert, or remove water which may affect the execution or condition of the Work. Water shall be satisfactorily removed from the site. The operation of earthwork shall be suspended at any time when satisfactory results cannot be obtained because inclement weather, or other unsatisfactory conditions in the field. At all times provide and maintain proper drainage for the working area limits.

E. Before beginning any Work specified in this section, ensure that all soil erosion and sediment control specifications are complied with and the proper state, county, or local authorities have been duly informed of the construction schedule. All erosion control features shall be installed prior to commencing earthwork operations and maintained throughout the duration of the work.

F. If it is necessary during the execution of the work to interrupt existing surface drainage or utilities, all necessary precautions to protect and preserve or provide temporary services for same shall be taken.

3.2 STOCKPILE

A. Stockpile materials on site at locations indicated on Drawings

B. Stockpile Fill in sufficient quantities to meet project schedule and requirements.

C. Maintain stockpiles during construction. Grade stockpiles to provide positive drainage to prevent erosion or deterioration of materials. Provide erosion control around stockpile.

D. Regrade and restore stockpile areas, after borrow excavation is complete or at completion of the project.

3.3 PREPARATION AND RESTORATION

A. Remove ice and snow before placing fill. Do not place fill on frozen subgrade.

B. Proof-roll subgrade before placing Geocomposite Clay Liner and fill using equipment equipped with smooth-drum roller.

C. Cut out soft areas of unsuitable subgrade.

D. Prepared surfaces on which compacted fill is to be placed shall be wetted or dried, as may be required to obtain the compacted specified herein.

E. Existing sloped ground surfaces steeper than 4 horizontal to 1 vertical on which fill is to be placed shall be plowed, stepped, or benched in such a manner that the fill material will bond with the existing surface.

3.4 PLACEMENT AND COMPACTION OF GENERAL FILL

A. Construct compacted fills, backfills, and embankments at the locations and to the lines and grades indicated on the Drawings.

B. Use approved material in the construction of fills, embankments, and backfills.

C. Place soil for compacted fills, backfills, and embankments in successive horizontal layers not exceeding 8 inches (loose) for the full width of the fill.

D. Construct each lift for the compacted embankments at least two feet beyond the slope line and cut back to line and grade after completion.

E. Spread each layer uniformly on a prepared surface (*i.e.,* a soil surface that has been moistened or aerated as necessary to maintain the percentage of optimum moisture contents as specified herein and scarified) or otherwise broken up in such a manner that the fill will bond with the surface on which it is being placed.

F. Compact general fill for compacted fills, backfills, and embankments to 95 percent of the maximum dry density as determined by Standard Proctor (ASTM D698), at ±3 percent of the optimum moisture content.

G. Compact backfill around headwalls and other drainage structures by hand or small compactor within 4 feet of the structure, to a density of 95 percent of maximum dry density based on the Standard Proctor Test (ASTM D698 or ASHTO T99) at ±3 percent of the optimum moisture content.

H. Provide sufficient water to obtain and maintain the specified moisture content. Material with an excessive moisture content shall be dried prior to compaction operations.

I. Do not compact the general fill component of the final cover unless noted otherwise on the Drawings.

J. Place general fill over the geocushion and geocomposite drainage layer by pushing material ahead of the equipment with an initial minimum lift thickness of 12 inches.

K. Use low ground pressure bulldozers to push the general fill out over the geocushion and geocomposite drainage layer. Refer to Sections 02072 and 02078.

3.5 PLACEMENT AND COMPACTION OF SELECT ASH FILL

A. Place and compact in maximum 8-inch–thick lifts.

B. Compact with a minimum of two passes with compaction equipment.

3.6 STANDARD COMPACTION

A. Provide each layer of fill to the degree that no further appreciable consolidation is evidence under the action of the compaction equipment. ENGINEER will require the compaction of the material to a dry density of at least 95 percent of the maximum dry density as determined by the Standard Proctor test.

3.7 TRENCH BACKFILLING

A. Backfill immediately following completion of pipe installation and documentation in accordance with Section 02317.

B. Take necessary precautions with backfill and construction operations to protect completed utility system from damage.

C. Backfill with care around structures and cleanouts.

D. Backfill to the original ground elevation unless shown otherwise on Drawings.

3.8 FIELD QUALITY CONTROL SELECT AGGREGATE FILL

A. The following tests will be performed under provisions of Section 01452.

Select Aggregate Fill

1. For every 1,000 linear foot placed: sieve analysis (ASTM D422).

2. For every 2,000 linear foot placed: a remolded constant head hydraulic conductivity test (ASTM D2434). The dry density and moisture content will be reported.

3.9 FIELD QUALITY CONTROL OF SELECT ASH FILL

A. ENGINEER will observe and document consistency of material and placement procedures.

3.10 BORROW SOURCE FOR SELECT FILL

A. Strip topsoil from area of select fill excavation. Leave topsoil stockpiled on site at borrow source until completion of work.

B. Bury cobbles removed from select fill.

C. Grade borrow area to provide positive drainage.

D. Replace topsoil. Seed, fertilize, and mulch borrow area.

END OF SECTION

SECTION 02372
RIPRAP

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Furnishing and placing 4-inch–diameter riprap at outlets of 4-inch–diameter corrugated polyethylene discharge pipe and grouted riprap at locations designated on the Drawings.

PART 2. PRODUCTS

2.1 MATERIALS

A. Durable field or quarry stone that is sound, hard, dense, angular, resistant to action of air and water, and free from seams, cracks, or other structural defects.

B. Grouted riprap: stone pieces meeting the size requirements for material classified as NCDOT Class B riprap as follows:

Stone Size	
15 inches	Maximum size
8 inches	Midrange size
5 inches	Minimum size

C. Four-inch riprap: stone pieces meeting the size requirements for material classified as NCDOT Class A riprap as follows:

Stone Size	
6 inches	Maximum size
4 inches	Midrange size
2 inches	Minimum size

D. Concrete pieces: sound and free of reinforcement meeting the same size requirements as stone may be substituted for 2.1B.

E. Grout: Durable, resistant cement grout or cement morter mixture compatible with riprap material. Strength for the grout of 2,000 to 2,500 psi required. Maximum size of aggregate should not exceed 3/4 inch. Slumps on the order of 5 to 7 inches are required to allow proper pumping and placement.

F. Geotextile as specified in Section 02076, with acceptance criteria as given in Table 02076-1.

PART 3. EXECUTION

3.1 PREPARATION

A. Construct to the lines, thickness, and grades required for placement of the riprap.

B. Place geotextile over prepared subgrade, and secure with anchor trenches as shown on the Drawings. Backfill and compact anchor trenches.

C. Place a minimum 6-inch–thick layer of crushed stone (ASTM C-33 Gradation #57) bedding over geotextile where grouted riprap is to be placed.

3.2 RIPRAP STONE PLACEMENT

A. Minimum thickness of riprap layer is 15 inches measured perpendicular to the slope unless shown otherwise on the Drawings.

B. Place riprap to the limits shown on the plans, and to within a 3-inch tolerance for thickness.

C. Do not drop riprap from a height greater than 12 inches.

D. Place riprap from the base of the slope upward. Place smaller sized stones to fill voids between the larger sized stones.

3.3 GROUT PLACEMENT

A. Grout should be mixed in a manner to produce a mixture having a consistency which will permit gravity flow into the intersticed of the dumped riprap with limited additional effort to effect distribution. Grout should generally be used within 30 minutes after mixing.

B. Place grout between riprap to fill all voids, leaving upper face of riprap exposed.

C. Grout placed on inverts or other nearly level areas may be placed in one course.

D. Grout placed on slopes should be placed on successive tiers approximately 10 feet in width, starting at the toe of the slope and progressing to the top.

E. Grout should be distributed over the riprapped surface as close as possible to the final position by a positive displacement pump or by a method that will prevent segregation of aggregate or loss of mortar.

F. Use suitable brooms, spades, trowels, bars, and vibrating equipment to distribute the grout over the riprapped surface and work into the space between stones from top to bottom.

G. Cure and protect grout for at least 7 days following placement to prevent and circumvent premature drying, extremes in temperature, mechanical damage, flowing water, and exposure to rain.

END OF SECTION

SECTION 02374
EROSION CONTROL FENCE

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Providing erosion control fence per the Detail in the Engineering Plans and maintaining erosion control fencing as shown on the Drawings and at other locations determined in the field by OWNER or ENGINEER.

PART 2. CONDITIONS WHERE PRACTICE APPLIES

A. Below small-disturbed areas that are less than ¼ acre per 100 feet of fence.

Where runoff can be stored behind the sediment fence without damaging the fence or the submerged area behind the fence.

Do not install sediment fences across streams, ditches, or waterways, or other areas of concentrated flow.

Sediment fence should be placed along topographic elevation contours, where it can intercept stormwater runoff that is in dispersed sheet flow. Sediment fence should not be used alone below graded slopes greater than 10 feet in height.

Ensure that drainage area is no greater than ¼ acre per 100 feet of fence. This is the maximum drainage area when the slope is less than 2 percent. Where all runoff is to be stored behind the fence, ensure that the maximum slope length behind a sediment fence does not exceed the following specifications:

SLOPE	SLOPE LENGTH (ft)	MAXIMUM AREA (ft^2)
<2%	100	10,000
2 to 5%	75	7,500
5 to 10%	50	5,000
10 to 20%	25	2,500
>20%	15	1,500

Provide a riprap splash pad or other outlet protection device for any point where flow may overtop the sediment fence, such as natural depressions or swales. Ensure that the maximum height of the fence at a protected, reinforced outlet does not exceed 2 feet and that support post spacing does not exceed 4 feet.

2.1 MATERIALS

Specifications for Sediment Fence Fabric

TEMPORARY SILT FENCE MATERIAL PROPERTY REQUIREMENTS					
	TEST MATERIAL	**UNITS**	**SUPPORTED[1] SILT FENCE**	**UN-SUPPORTED[1] SILT FENCE**	**TYPE OF VALUE**
Grab strength	ASTM D4632	N (lbs)			
Machine direction			400 (90)	550 (90)	MARV
X-Machine direction			400 (90)	450 (90)	MARV
Permittivity[2]	ASTM D4491	sec-1	0.05	0.05	MARV
Apparent opening size[2]	ASTM D4751	Mm (US Sieve #)	0.60 (30)	0.60 (30)	Max. ARV[3]
Ultraviolet stability	ASTM D4355	% retained strength	70% after 500h of exposure	70% after 500h of exposure	Typical

Notes:
(1) Silt fence support shall consist of 14 gage steel wire with a mesh spacing of 150 mm (6 inches), or prefabricated polymer mesh of equivalent strength.
(2) These default values are based on empirical evidence with a variety of sediment. For environmentally sensitive areas, a review of previous experience and/or site or regionally specific geotextile tests in accordance with Test Method D5141 should be performed by the agency to confirm suitability of these requirements.
(3) As measured in accordance with Test Method D4632.

A. Materials provided for the installation of erosion control measures and practices shall be subject to the approval of the OWNER or ENGINEER.

PART 3. EXECUTION

3.1 CONSTRUCTION MATERIALS

A. Use a synthetic filter fabric of at least 95% by weight of polyolefins or polyester, which is certified by the manufacturer or supplier as conforming to the requirements in ASTM D6461.

Synthetic filter fabric should contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0 to 120°F.

B. Ensure that posts for sediment fences are 1.33 lb/linear ft steel with a minimum length of 5 feet. Make sure that steel posts have projections to facilitate fastening the fabric.

C. For reinforcement of standard strength filter fabric, use wire fence with a minimum 14 gauge and a maximum mesh spacing of 6 inches.

3.2 CONSTRUCTION

A. Construct the sediment barrier of standard strength or extra strength synthetic filter fabrics.

B. Construct the filter fabric from a continuous roll cut to the length of the barrier to avoid joints. When joints are necessary, securely fasten the filter cloth only at a support post with 4 feet minimum overlap to the next post.

C. Support standard strength filter fabric by wire mesh fastened securely to the upslope side of the posts. Extend the wire mesh support to the bottom of the trench. Fasten the wire reinforcement, then fabric on the upslope side of the fence post. Wire or plastic zip ties should have minimum 50 pound tensile strength.

D. When a wire mesh support fence is used, space posts a maximum of 8 feet apart. Support posts should be driven securely into the ground a minimum of 24 inches.

E. Extra strength filter fabric with 6 feet post spacing does not require wire mesh support fence. Securely fasten the filter fabric directly to posts. Wire or plastic zip ties should have minimum 50 pound tensile strength.

F. The base of both end posts should be at least one foot higher than the middle of the fence. Check with a level if necessary.

G. Install posts 4 feet apart in critical areas and 6 feet apart on standard applications.

H. Install posts 2 feet deep on the downstream side of the silt fence, and as close as possible to the fabric, enabling posts to support the fabric from upstream water pressure.

I. Install posts with the nipples facing away from the silt fabric.

J. Attach the fabric to each post with three ties, all spaced within the top 8 inches of the fabric. Attach each tie diagonally 45 degrees through the fabric, with each puncture at least 1 inch vertically apart. Also, each tie should be positioned to hang on a post nipple when tightened to prevent sagging.

K. Wrap approximately 6 inches of fabric around the end posts and secure with 3 ties.

L. No more than 24 inches of a 36 inch fabric is allowed above ground level.

M. The installation should be checked and corrected for any deviations before compaction.

N. Excavate a trench approximately 4 inches wide and 8 inches deep along the proposed line of posts and upslope from the barrier, as shown on the Detail in the Erosion and Sediment Control Plan dated July 2010.

O. Place 12 inches of the fabric along the bottom and side of the trench.

P. Backfill the trench with soil placed over the filter fabric and compact.

Q. Compaction is vitally important for effective results. Compact the soil immediately next to the silt fence fabric with the front wheel of the tractor, skid steer, or roller exerting at least 60 pounds per square inch. Compact the upstream side first, and then each side twice for a total of 4 trips.

R. Do not attach filter fabric to existing trees.

SEDIMENT FENCE INSTALLATION USING THE SLICING METHOD
Instead of excavating a trench, placing fabric and then backfilling trench, sediment fence may be installed using specially designed equipment that inserts the fabric into a cut sliced in the ground with a disc.

PART 4. MAINTENANCE

A. Inspect sediment fences at least once a week and after each rainfall. Make any required repairs immediately.

Should the fabric of a sediment fence collapse, tear, decompose or become ineffective, replace it promptly.

Remove sediment deposits as necessary to provide adequate storage volume for the next rain and to reduce pressure on the fence. Take care to avoid undermining the fence during cleanout.

Remove all fencing materials and unstable sediment deposits and bring the area to grade and stabilize it after the contributing drainage area has been properly stabilized.

END OF SECTION

SECTION 02376
EROSION CONTROL MATERIAL

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Providing Erosion Control and Revegetation Mat (ECRM) and Turf Reinforcement Mat (TRM) on terraces, ditches, or slope protection at the locations identified on the Drawings to hold soil in place until suitable vegetative root system can be established.

1.2 REFERENCE STANDARDS

A. North Carolina Department of Transportation Standard Specifications for Roads and Structures; 1995 Edition (NC DOT).

B. North Carolina Department of Environment and Natural Resources and Sediment Control Planning and Design Manual, 1998 Edition (NC DENR).

1.3 DELIVERY, STORAGE, AND HANDLING

A. Matting should be delivered with a wrap that will protect the mat from moisture, abrasion, and ultraviolet radiation.

B. Store out of direct sunlight, dust, and debris.

C. Inspect material prior to deployment and indicate in writing any deficiencies to the OWNER or ENGINEER.

D. Handle with care not to damage mat.

E. Label mat and/or its container with the manufacturer's name, brand name, roll or lot number, and quantity.

PART 2. PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. TRM – Propex Operating Company, LLC, 6025 Lee Highway, Suite 425, Chattanooga, TN 37422 (800) 621-1273, or approved equal.

B. ECRM – North American Green, 5401 St. Wendel-Cynthiana Road, Poseyville, IN 47633 (800) 772-2040.

C. Substitutions: Under provisions of Section 01600.

2.2 MATERIALS

A. TRM – Landlock TRM or approved equal.

B. ECRM – North American Green BioNet® S150BN™ or approved equal.

C. The ECRM shall have a minimum longevity of 12 months and TRM shall have a permanent life.

D. The ECRM shall consist of straw with reinforcement of biodegradable netting.

E. Anchors: Use anchors and trenching specified by the mat manufacturer.

PART 3. EXECUTION

3.1 PREPARATION

A. Grade area, remove sharp objects and other unsuitable materials prior to placement.

3.2 INSTALLATION

A. Apply lime, fertilizer, and seed before laying the mat.

B. Install in accordance with the manufacturer's instructions, NC DENR Section 6.14, and NC DOT Section 1631.

C. In the presence of wind, erosion control mat shall be weighted with sandbags or equivalent. Such sandbags shall be installed during placement and shall remain until mat can be secured per manufacturer's specifications.

D. Overlap roll ends a minimum of 3 feet, with upslope mat on top.

E. Overlap adjacent edges per manufacturer's requirements.

F. Anchor edges in a trench per manufacturer's requirements.

G. Staple mat at intervals and frequencies per manufacturer's requirements.

H. Backfill all trenches with topsoil and compact.

3.3 MAINTENANCE

A. Examination of matting after installation shall be conducted to ensure that no potentially harmful foreign objects are present. Any objects encountered shall be removed.

END OF SECTION

SECTION 02536
OUTLET STABILIZATION STRUCTURE

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Construct structure designed to control erosion at the outlet of a channel or conduit as shown on Detail in the Erosion and Sediment Control Plan dated July 2010.

1.2 SUBMITTALS

A. Comply with provisions of Section 01330.

PART 2. CONDITIONS WHERE PRACTICE APPLIES

A. Location of outlet stabilization structure are provided on the Engineering Drawings. This practice applies where the discharge velocity of a pipe, box culvert, diversion, open channel, or other water conveyance structure exceeds the permissible velocity of the receiving channel or disposal area.

PART 3. EXECUTION

3.1 CONSTRUCTION

A. Ensure that the subgrade for the filter and riprap follows the required lines and grades shown in the plan. Compact any fill required in the subgrade to the density of the surrounding undisturbed material. Low areas in the subgrade on undisturbed soil may also be filled by increasing the riprap thickness.

B. The riprap and gravel filter must conform to the specified grading limits shown on the plans.

C. Filter cloth must be properly protected from punching or tearing during installation. Repair any damage by removing the riprap and placing another piece of filter cloth over the damaged area. All connecting joints should overlap so the top layer is above the downstream layer a minimum of 1 foot. If the damage is extensive, replace the entire filter cloth.

D. Riprap may be placed by equipment, but take care to avoid damaging the filter.

E. The minimum thickness of the riprap should be 1.5 times the maximum stone diameter.

F. Riprap may be field stone or rough quarry stone. It should be hard, angular, highly weather-resistant and well graded.

G. Construct the apron on zero grade with no overfill at the end. Make the top of the riprap at the downstream end level with the receiving area or slightly below it.

H. Ensure that the apron is properly aligned with the receiving stream and preferably straight throughout its length. If a curve is needed to fit site conditions, place it in the upper section of the apron.

I. Immediately after construction, stabilize all disturbed areas with vegetation.

PART 4. MAINTENANCE

A. Inspect riprap outlet structures weekly and after significant (½ inch or greater) rainfall events to see if any erosion around or below the riprap has taken place, or if stones have been dislodged. Immediately make all needed repairs to prevent further damage.

END OF SECTION

SECTION 02618
HIGH-DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Providing High Density Polyethylene (HDPE) Pipe, fittings and appurtenances for gas piping and for downslope flume pipe as indicated on Drawings.

1.2 REFERENCES

A. ASTM D4976 – Polyethylene plastics molding and extrusion materials

B. ASTM D3350 – Standard specification for polyethylene plastic pipe and fittings materials.

C. ASTM D3261 – Butt fittings for HDPE pipes.

D. ASTM D2513 – Industrial molded fittings for HDPE pipes.

E. ASTM D2683 – Socket fittings for HDPE pipes

1.3 QUALITY CONTROL REQUIREMENTS

A. Prior to delivery of piping to the site, the Piping Manufacturer will provide the following information:

1. Resin supplier's name, location of supplier's production plant(s), and the resin brand name and product number.

2. Test results obtained by the piping manufacturer and/or the piping manufacturer's testing laboratories to document the quality of the resin used in manufacturing the piping.

B. The Piping Manufacturer will provide certification, based on test results, that:

1. Pipe supplied meets all Material Specifications in Section 02618 2.2.

2. Finished pipe meets the cell classification of 345434C according to the provisions of ASTM D3350

3. Finished pipe has the SDR value specified.

1.4 DELIVERY, STORAGE AND HANDLING

A. Each bundle of pipe prepared for shipment by the Piping Fabricator will be marked with the following information:

1. Nominal size

2. Dimension ratio

3. Pressure rating

4. Type (manufacturer)

5. Material classification

B. Comply with requirements of Section 01600 – Material and Equipment.

C. Protect pipe during shipment from excessive heat or cold, puncture, or other damaging or deleterious conditions

D. Protect pipe on-site from long-term ultraviolet exposure, the elements, weather changes, and construction activities.

E. Store materials in areas that are safe from construction activities.

1.5 SUBMITTALS

A. Submit product data under provisions of 01330.

B. Provide data on pipe materials, pipe fittings, and accessories.

PART 2. PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS/SUPPLIERS

A. Pipe and Valves:

1. Plastic Fusion Fabricators
3455 Stanwood Blvd.
Huntsville, AL 35811
800/356-1480

2. Michigan Supply Company
631 Park Place
Lansing, MI 48901
517/484-6444

3. Isco Industries
926 Baxter Avenue
Louisville, KY 40204
800/345-4726

4. Forrer Supply Company, Inc.
W194 N11811 McCormick Drive
Germantown, WI 53022
800/255-1030

5. ADS, Inc.
4640 Trueman Blvd.
Hilliard, OH 43026

B. Substitutions: Under Provisions of Section 1600.

2.2 MATERIALS

A. Only new and undamaged materials shall be used.

B. HDPE pipe and fittings shall be made from high-density, extra high molecular weight material with a broad range molecular weight distribution designated as PE 3408 with an ASTM D3350 cell classification number of 345434C.

C. SDR 17, 21 and 32.5 HDPE piping: 4, 6, 8, 18, and 24-inch diameter, complete with bends, fittings, and appurtenances, as shown on the Drawings.

D. Joints: Thermal butt fusion process according to manufacturer's specifications and ASTM D2687.

E. ADS Piping: N-12 WT IB watertight pipe.

F. ADS piping and fittings shall be made of virgin polyethylene compounds that comply with the cell classification 424420C as defined and described in ASTM D3350, except that carbon black content should not exceed 4%.

G. ADS Pipe Joints: Split or snap couplings according to MANUFACTURER's specifications.

PART 3. EXECUTION

3.1 INSPECTION

A. Inspect pipe, fittings, and other appurtenances before installation to verify quality of material.

B. Bends to be prefabricated in the field, prefabricated, or made by bending straight sections of pipe.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove dirt and foreign material, inside and outside, from pipe and fitting materials before assembly.

C. Make straight field cuts without chipping or cracking the pipe.

3.3 BEDDING

A. As shown on the Drawings, in accordance with Section 02317.

3.4 INSTALLATION

A. Pipe seams: Make thermal butt fusion joints in accordance with the manufacturer's specifications.

B. Install pipe and HDPE fittings to the line and grade specified on the Drawings.

C. Lay pipe from the low end toward the high point. Provide continuous smooth invert.

D. Pipe placement will not be performed in the presence of excessive moisture or when the underlying prepared surface has deteriorated since previous acceptance.

E. Maximum allowable tolerance for grade is 0.20 foot.

F. Install bedding and backfill material over pipe as designated in the drawings with care to avoid damage to pipe. Minimize traffic and turning of traffic over pipe.

3.5 FIELD QUALITY CONTROL

A. ENGINEER to observe pipe subgrade installation, and pipe installation prior to backfilling.

B. When fusing joints and fittings, follow supplied manufacturer's directions and procedures for heat jointing pipes and fittings.

C. Pipe inverts and coordinate locations may be surveyed at 100-foot intervals and at fitting locations.

END OF SECTION

SECTION 02720
AGGREGATE BASE COURSE

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Constructing a dense compacted Aggregate Base Course access road. The Aggregate Base Course will serve as the final surface for the access road.

1.2 REFERENCES

A. North Carolina Department of Transportation, Standard Specifications for Roads and Structures (2002 Edition).

1.3 SUBMITTALS

A. Submit test results under provisions of Section 01330, indicating that the Aggregate Base Course meets the required specifications.

PART 2. PRODUCTS

2.1 MATERIALS

A. Aggregate Base Course: Crushed stone or gravel which is well graded from the 1 ½-inch through the No. 200 sieve sizes that conforms to the provisions of NCDOT Standard Specifications for Roads and Structures Article 1006. Match to existing stone/gravel to the extent possible.

PART 3. EXECUTION

3.1 INSPECTION

A. ENGINEER to observe and approve subgrade prior to Base Course placement.

B. Apply water to dry subgrade before placement, and rework or recompact as necessary.

3.2 INSTALLATION

A. Aggregate Base Course: Deposit Base Course material on the subgrade in a manner to minimize segregation and facilitate spreading to a uniform uncompacted layer not less than 5 inches in depth. Construct the Access Road Aggregate Base Course in two or more layers.

B. Add water as necessary to assist compaction. If excess water is apparent, aerate Aggregate Base Course material to reduce the moisture content.

C. Compact each layer of Aggregate Base Course material to the degree that no further appreciable consolidation or movement of the base is evidenced under action of the compaction equipment.

D. Rework or remove and replace soft or yielding areas as required until proper compaction is obtained. The cost of such reworking or removal and replacement shall be at CONTRACTOR's expense.

E. Regrade and repair existing access road by using an Aggregate Base Course Material. Types, depths, and limits of the Base Course layers to be determined by ENGINEER.

END OF SECTION

SECTION 02743
DOWNSLOPE FLUME (CHUTES)

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Construct downslope pipe flumes to convey water on a relatively steep slope, as shown on Details in the Erosion and Sediment Control Plan dated July 2010.

1.2 SUBMITTALS

A. Comply with provisions on Section 01330.

PART 2. CONDITIONS WHERE PRACTICE APPLIES

A. Where concentrated storm runoff must be conveyed from the top to the bottom of a cut or fill slope as part of a permanent erosion control system. Piped flumes serve as stable outlets for diversions, drainage channels, or natural drainageways that are located above relatively steep slopes. Locations and conditions are provided on the Engineering Drawings.

PART 3. EXECUTION

3.1 CONSTRUCTION

A. Construct the subgrade to the elevations shown on the plans. Remove all unsuitable material and replace them with stable materials. Compact the subgrade thoroughly and shape it to a smooth, uniform surface. Keep the subgrade moist at the time concrete is poured. On fill slopes, ensure that the soil adjacent to the chute for at least 3 feet is well-compacted.

B. Place concrete for the flume to the thickness shown on the plans and finish it in a workman-like manner.

C. Form, reinforce, and pour together cutoff walls, anchor lugs, and channel linings.

D. Take adequate precautions to protect freshly poured concrete from extreme temperatures to ensure proper curing.

E. Provide transverse (contraction) joints to control cracking at approximately 20-feet intervals. Joints may be formed by using a ⅛-inch thick removable template or by sawing to a depth of at least 1 inch.

F. In very long flumes, install expansion joints at intervals not to exceed 50 feet.

G. Place filters and foundation drains, when required, in the manner specified, and protect them from contamination when pouring the concrete flume.

H. Properly stabilize all disturbed areas immediately after construction.

PART 4. MAINTENANCE

A. Inspect flumes after each rainfall until all areas adjoining the flume are permanently stabilized. Repair all damage noted in inspections immediately. After the slopes are stabilized, flumes need only periodic inspection, and inspection after major storm events.

END OF SECTION

SECTION 02911
TOPSOIL

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Stripping Topsoil from the borrow area and stockpiling or placing on the final cover or over other disturbed areas.

B. Moving Topsoil from on-site stockpiles and placing on the final cover.

PART 2. PRODUCTS

2.1 MATERIALS

A. Friable, fertile, loamy soil containing an amount of organic matter normal to the region, capable of sustaining healthy plant life.

B. Free from refuse, subsoils, materials toxic to plant growth, and foreign objects.

PART 3. EXECUTION

3.1 PREPARATION

A. Remove vegetation, foreign materials, unsatisfactory or contaminated soils, obstructions, and matter harmful to plant growth from ground surface before placement.

B. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

C. Scarify subsoil to a depth of 3 inches where Topsoil is to be placed. Repeat cultivation in areas where equipment used for hauling and spreading Topsoil has compacted subsoil.

3.2 STRIPPING AND STOCKPILING

A. Strip Topsoil from borrow area and stockpile in Topsoil Stockpile Area approved by OWNER or ENGINEER.

B. Strip Topsoil to the available depth, taking care not to incorporate subgrade soils.

3.3 PLACEMENT

A. Place Topsoil to a uniform depth of 6 inches.

B. Finish grade topsoil on the final cover within a thickness tolerance of 0.0 feet to +0.10 feet.

C. Break down clods and lumps.

END OF SECTION

SECTION 02921
SEEDING

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Temporary Seeding Requirements.

B. Permanent Seeding Requirements.

C. Preparing the Topsoil.

D. Hydroseeding Application.

E. Mulching.

1.2 REFERENCE STANDARDS

A. North Carolina Department of Transportation Standard Specifications for Roads and Structures, 1995 Edition (NC DOT)

B. North Carolina Department of Environment and Natural Resources, Erosion and Sediment Control Planning and Design Manual, 1998 Edition (NC DENR)

1.3 DEFINITIONS

A. Weeds: Includes, but is not limited to, Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.4 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

B. Soil amendments (fertilizer and lime) shall be applied based on testing of the soil per Specification 02923.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

B. Seed which is wet, moldy, or otherwise damaged is not acceptable.

1.6 UNIT PRICES

A. Measure and pay for Seedings by the acre.

PART 2. PRODUCTS

2.1 SEED MIXTURE

Seed mixture shall conform to NC DOT Section 1060-4 and NC DENR Erosion and Sediment Control Planning and Design Manual Section 6.10 and Section 6.11.

A. Temporary Seeding

SEED MIXTURE	APPLICATION RATE (lb/acre)
Rye (Grain)	120

B. Permanent Seeding (immediate and primary stabilization seeding)

SEED MIXTURE	APPLICATION RATE (lb/acre)	SEEDING DATES
Kentucky 31 Fescue	50	April 1 to July 15 or as approved by OWNER or ENGINEER
Common Bermuda	30	
Pensacola Bahia	30	
Annual Rye Grass	5	
Rye Grain	20	
Reseeding Crimson Clover	20	

2.2 ACCESSORIES

A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

PART 3. EXECUTION

3.1 INSPECTION

A. Verify that prepared soil base is ready to be seeded.

3.2 PREPARATION OF TOPSOIL

A. Grade Topsoil to finish grades to ensure positive drainage.

B. Remove stones or objects over 2 inches in diameter, foreign materials, weeds, and undesirable plants and their roots. Remove contaminated topsoil.

C. Apply fertilizer and lime immediately before seeding in accordance with Section 02923.

3.3 HYDROSEEDING

A. Reference NC DOT Section 1060 and Section 1660 and NC DENR Erosion and Sediment Control Planning and Design Manual Section 6.10 and Section 6.11

B. A hydroseeder may be used if deemed more appropriate for seeding, particularly for slopes. If used, the hydroseeder shall have continuous agitating action that keeps the seed uniformly mixed in the slurry until pumped from the tank. Do not mix seed and fertilizer more than 30 minutes before application.

3.4 MULCHING

A. Reference NC DOT Section 1060 and Section 1660 and NC DENR Section 6.10, Section 6.11, and Section 6.14.

B. Immediately following mulching, roll mulched area. On large areas, a cultipacker may be used to roll and cover the seed.

C. Apply 2 tons/acre grain straw or equivalent cover of another suitable mulch.

3.5 WATERING

A. Apply water with a fine spray immediately after each area has been mulched. Saturate soil to a depth of 4 inches.

B. Keep the surface layer of soil damp by frequent light watering with a fine spray during the germination period when rainfall is insufficient.

3.6 MAINTENANCE

A. Maintain seeded areas until vegetation is established.

B. Reseed areas where vegetation has not established until vegetation is established.

END OF SECTION

SECTION 02923
FERTILIZING

PART 1. GENERAL

1.1 SECTION INCLUDES

A. Provide fertilizer and lime.

B. Apply fertilizer and lime.

1.2 REFERENCE STANDARDS

A. North Carolina Department of Transportation Standard Specifications for Roads and Structures, 2002 Edition (NC DOT)

B. North Carolina Department of Environment and Natural Resources, Erosion and Sediment Control Planning and Design Manual, 2009 Edition (NC DENR)

1.3 REGULATORY REQUIREMENTS

A. Comply with regulatory agency's requirements for fertilizer composition.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

B. Fertilizer that is wet, contains foreign debris, or is otherwise damaged is not acceptable.

1.5 UNIT PRICES

A. Fertilizing is incidental to the cost of seed, fertilize, and mulch.

PART 2. PRODUCTS

2.1 FERTILIZER MIXTURE

A. Fertilizer shall conform to NC DOT Section 1060 and NC DENR Section 6.11 except as given herein.

1. For Permanent Seeding - Fertilizer shall be based on results of North Carolina Department of Agriculture Soil Tests (or equal), uniform composition, free-flowing and suitable for application with approved equipment, delivered to the site in bags or other convenient containers, each fully labeled, including the following information: Name and address of manufacturer; name bound or trademark; number of net pounds of ready mix material in the package; chemical composition of analysis and guarantee of analysis.

2. For Temporary Seeding – Fertilizer shall be 10-10-10, uniform composition, free-flowing and suitable for application with approved equipment, delivered to the site in bags or other convenient containers, each fully labeled, including the following information: Name and address of manufacturer; name bound or trademark;

number of net pounds of ready mix material in the package; chemical composition of analysis and guarantee of analysis.

B. Lime shall conform to NC DOT Section 1060 and Section 1660 and NC DENR Section 6.11.

PART 3. EXECUTION

3.1 INSPECTION

A. Verify that area is ready to receive the work of this Section.

B. ENGINEER must accept existing site conditions before beginning installation.

3.2 APPLICATION OF FERTILIZER AND LIME

A. Apply fertilizer immediately before seeding.

B. Apply after topsoil is raked smooth and prior to roller compaction.

C. Do not apply fertilizer at same time or with same machine that will be used to apply seed, unless hydroseeding is performed.

D. Mix thoroughly into upper 4-6 inches of topsoil.

E. Lightly water to aid the dispersion of fertilizer.

END OF SECTION

Domtar

DOMTAR PAPER COMPANY, LLC

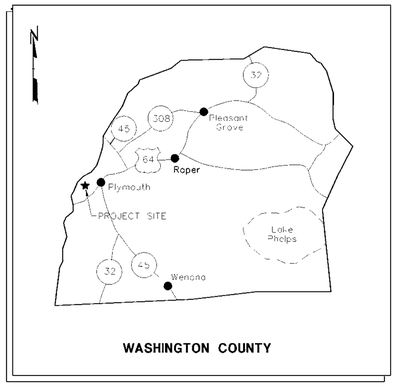
LANDFILL NO. 3 - PHASE 1A & 1B CLOSURE

PREPARED FOR: DOMTAR PAPER COMPANY, LLC
PLYMOUTH, NORTH CAROLINA

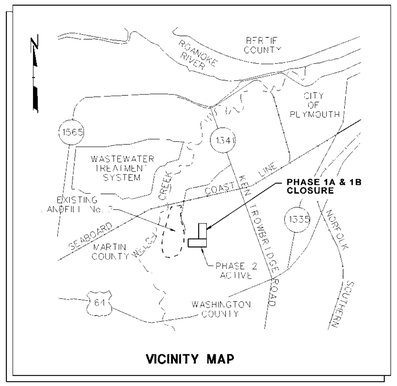
PREPARED BY: RMT NORTH CAROLINA, INC.

DATE: JULY 2010

NORTH CAROLINA



WASHINGTON COUNTY



VICINITY MAP

LEGEND

	EXISTING	PROPOSED
ACCESS ROAD		
BUILDING		
CONTOUR	34	34
WETLANDS		
DRAINAGE FLOW DIRECTION		
MONITORING WELL		
CONTROL POINT		
POWER POLE (LIGHT POLE)		
RIP RAP OR CRUSHED STONE		
SPOT ELEVATION		• 34.2
TREE LINE		
PROPERTY LINE		
LIMITS OF COMPOSITE COVER CONSTRUCTION		
GAS VENT PIPING		GVP
GAS VENT		
EROSION CONTROL FENCE		SF

GENERAL NOTES

1. EXISTING PLANIMETRIC AND TOPOGRAPHIC INFORMATION THAT LIES WITHIN THE FOOTPRINT OF LANDFILL No. 3 (PHASE 1A & 1B) WAS DEVELOPED FROM A SURVEY PERFORMED BY OMANCE & ASSOCIATES, INC., NEW BERRY, NORTH CAROLINA DATE OF SURVEY: APRIL 15, 2010.

2. CONTROL MONUMENT INFORMATION:

NCGS MONUMENT "ADVISOR"	NCGS MONUMENT "BENNETT"
GRID COORDINATES	GRID COORDINATES
N=765,198.28'	N=764,433.87'
E=2,659,512.73'	E=2,658,436.50'
(NAD 83)	(NAD 83)
ELEV = 39.12'	ELEV = 37.21'
(NGVD 29)	(NGVD 29)

3. PLANIMETRIC AND TOPOGRAPHIC INFORMATION THAT FALLS OUTSIDE THE LIMITS OF LANDFILL No. 3 (PHASE 1A & 1B) AS DESCRIBED IN NOTE 1 WAS DEVELOPED FROM A SURVEY PERFORMED BY McKIM & CREED ENGINEERING, INC., CAREY, NORTH CAROLINA, DATED APRIL 26, 2001. ALL COORDINATES AND BEARINGS ARE BASED ON THE NORTH CAROLINA STATE PLANE COORDINATE SYSTEM, NAD 83. ALL ELEVATIONS SHOWN ARE IN FEET AND ARE BASED ON NGVD 1929 DATUM. PROPERTY LINES BASED ON SURVEY PROVIDED BY McKIM & CREED AND INFORMATION PROVIDED BY WEYERHAEUSER COMPANY. ELEVATIONS SHOWN IN THE BORROW AREAS (PLAN SHEET 4) HAVE BEEN ALTERED BY PREVIOUS CONSTRUCTION.

4. THE PROPOSED SITE IS LOCATED IN WASHINGTON COUNTY, SOUTHWEST OF THE CITY OF PLYMOUTH, NORTH CAROLINA, AS SHOWN ON THE VICINITY MAP.

5. ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE IMPLEMENTED, MONITORED, AND MAINTAINED ON A REGULAR BASIS TO ASSURE MAXIMUM EFFICIENCY IN CONTAINING SEDIMENTS WITHIN THE PROPERTY DURING AND AFTER LANDFILL/EARTHWORK OPERATIONS UNTIL THE DISTURBED AREAS ARE REVEGETATED OR OTHERWISE STABILIZED. CONTRACTOR SHALL COMPLY WITH THE PHASE 1A & 1B CLOSURE AND BORROW AREA AND HAUL ROAD EROSION AND SEDIMENT CONTROL PLANS, DATED JULY 2010.

6. UNLESS NOTED OTHERWISE, NEW CONTOURS AND/OR NEW SPOT ELEVATIONS REPRESENT THE FINAL GRADE. ALLOWANCE SHALL BE MADE FOR THE FINAL COVER CONFIGURATION.

7. PRESERVE AND PROTECT ALL MONITORING WELL AND OTHER ENVIRONMENTAL MONITORING FEATURES. DAMAGED FEATURES WILL BE REPAIRED BY THE OWNER AT THE CONTRACTORS EXPENSE.

ABBREVIATIONS

APPROX	APPROXIMATELY	I.E.	INVERT ELEVATION
ASTM	AMERICAN SOCIETY FOR TESTING MATERIALS	INV EL	INVERT ELEVATION
BM	BENCH MARK	LF	LINEAR FEET
℄	CENTERLINE	LC	LEACHATE COLLECTION
CHDPE	CORRUGATED HIGH DENSITY POLYETHYLENE	LP	LIGHT POLE
CONC	CONCRETE	LFM	LEACHATE FORCE MAIN
CS	CARBON STEEL	MAX	MAXIMUM
CSP	CORRUGATED STEEL PIPE	MH	MANHOLE
DIA	DIAMETER	MIN	MINIMUM
DET	DETAIL	MISC	MISCELLANEOUS
DI	DROP INLET	N	NORTH
DWG	DRAWING	NO.	NUMBER
E	EAST	NTS	NOT TO SCALE
EA	EACH	OD	OUTSIDE DIAMETER
ELE/ELEV	ELEVATION	PERF	PERFORATED
EXIST	EXISTING	PI	POINT OF INTERSECTION
FT	FEET	PC	POINT OF CURVATURE
FUT	FUTURE	⅊	PROPERTY LINE
FM	FORCE MAIN	PSF	POUNDS PER SQUARE FT.
GA	GAGE, GAUGE	PSI	POUNDS PER SQUARE IN.
GALV	GALVANIZED	R	RADIUS
GR	GRADE	REV	REVISION
HDPE	HIGH DENSITY POLYETHYLENE	REQ'D	REQUIRED
HORIZ	HORIZONTAL	RR	RAILROAD
HP	HIGH POINT	SAN	SANITARY SEWER
HW	HEADWALL	SECT	SECTION
ID	INSIDE DIAMETER	STA	STATION
		STD	STANDARD
		T/CONC	TOP OF CONCRETE
		TYP	TYPICAL
		W/	WITH

DRAWING LIST

SHEET NO.	TITLE
1	TITLE SHEET
2	EXISTING CONDITIONS MAP AND SITE LAYOUT
3	FINAL GRADES
4	BORROW AREA SITE PLAN
5	DOWNSLOPE FLUME LAYOUT
6	ENGINEERING CROSS SECTIONS 769400N & 2658630E
7	DETAILS
8	DETAILS
9	DETAILS
10	DETAILS

NOTE: THE CONTRACTOR SHALL NOTIFY ALL AREA UTILITY COMPANIES PRIOR TO COMMENCING WORK ON THIS CONTRACT, IN ACCORDANCE WITH STATE AND LOCAL REQUIREMENTS.

NOTE: THESE PLANS ARE ACCOMPANIED BY A PROJECT MANUAL OF THE SAME TITLE. THESE DOCUMENTS ARE INTERRELATED AND ARE INTENDED TO BE USED TOGETHER.

RMT

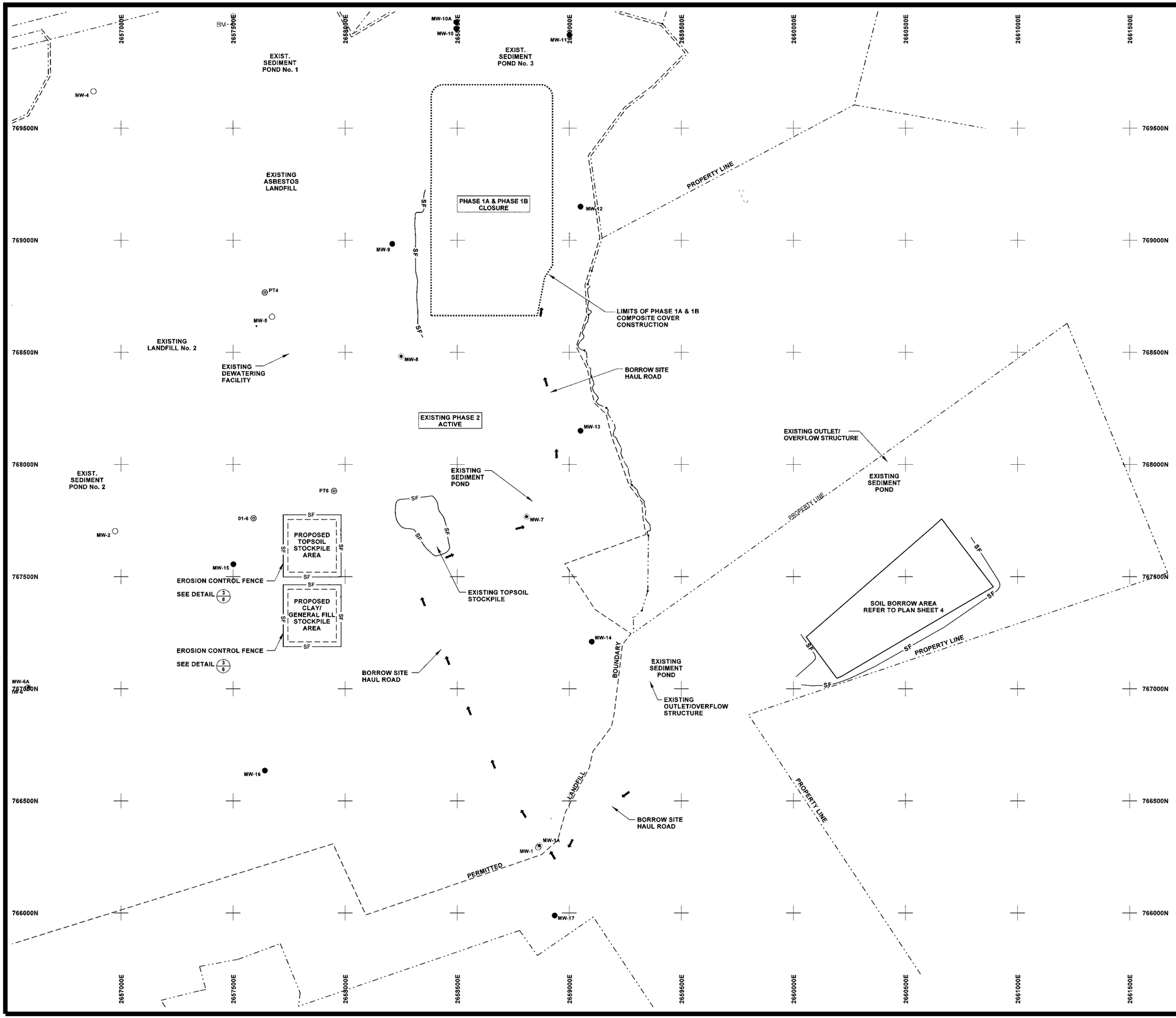
NORTH CAROLINA, INC.
LICENSE NO. F-0490

Plot Data
Design File: J:\00-7777\41\title.pt
Cell Name: TITLE
Plot Scale: 1:1.00-7777\41\title.pt
Plot File: J:\00-7777\41\title.plt
Plotter: HP DESIGNJET 4000PS
Paper Size: 36.00 X 24.00 IN
Rotation: 0.000000
Origin: 0.000000, 0.000000
Date/Time: 3/18/08 2:30
Levels On: 1 63

Reference Files
Ref File 1: J:\00-7777\41\base.pt
Ref File 2: J:\00-7777\41\base.pt
Ref File 3: J:\00-7777\41\base.pt
Ref File 4: J:\00-7777\41\base.pt
Ref File 5: J:\00-7777\41\base.pt
Ref File 6: J:\00-7777\41\base.pt
Ref File 7: J:\00-7777\41\base.pt
Ref File 8: J:\00-7777\41\base.pt
Ref File 9: J:\00-7777\41\base.pt
Ref File 10: J:\00-7777\41\base.pt

Logical Names
(1) no ref logical
(2) no ref logical
(3) no ref logical
(4) no ref logical
(5) no ref logical
(6) no ref logical
(7) no ref logical
(8) no ref logical
(9) no ref logical
(10) no ref logical

Levels
(1) no ref levels
(2) no ref levels
(3) no ref levels
(4) no ref levels
(5) no ref levels
(6) no ref levels
(7) no ref levels
(8) no ref levels
(9) no ref levels
(10) no ref levels



NOTES

1. REFER TO PLAN SHEET 1 FOR LEGEND, ABBREVIATIONS AND GENERAL NOTES.
2. BORROW SITE HAUL ROAD UPGRADES SHALL BE APPROVED BY THE OWNER\ENGINEER PRIOR TO IMPLEMETATION.
3. EXISTING TOPSOIL STOCKPILE SHALL BE REMOVED AND USED FOR PHASE 1A & 1B CLOSURE. ANY REMAINING UNUSED TOPSOIL SHALL BE PLACED IN THE PROPOSED TOPSOIL STOCKPILE AREA.
4. WHEN CONSTRUCTION IS COMPLETED, REGRADE AND SEED STOCKPILES TO PROVIDE POSITIVE DRAINAGE ON AND AROUND STOCKPILES.

HORIZONTAL/VERTICAL CONTROL POINTS

POINT I.D.	NORTH COORDINATE	EAST COORDINATE	COMMENT
PT4	768766.97	2657640.89	IRS CAP - ELEV. 37.28 MSL
PT6	767882.15	2657950.26	IRS CAP - ELEV. 42.10 MSL
01-6	767759.89	2657590.77	ELEV. 59.00 MSL

0 200 400 600 800

SCALE 1"= 200'

NOTE: THE CONTRACTOR SHALL NOTIFY ALL AREA UTILITY COMPANIES PRIOR TO COMMENCING WORK ON THIS CONTRACT, IN ACCORDANCE WITH STATE AND LOCAL REQUIREMENTS.

NOTE: THESE PLANS ARE ACCOMPANIED BY A PROJECT MANUAL OF THE SAME TITLE. THESE DOCUMENTS ARE INTERRELATED AND ARE INTENDED TO BE USED TOGETHER.

NO.	BY	DATE	REVISION	APP'D.
3.				
2.				
1.				

PROJECT: **LANDFILL No. 3 - PHASE 1A & 1B CLOSURE**
DOMTAR PAPER COMPANY, LLC
PLYMOUTH, NORTH CAROLINA

SHEET TITLE:
EXISTING CONDITIONS MAP AND SITE LAYOUT

DRAWN BY:	noldenr	SCALE:	1"=200'	PROJ. NO.	00-71717.41
CHECKED BY:	TDH			FILE NO.	EXISTING.PLT
APPROVED BY:	TWM	DATE PRINTED:		SHEET 2 OF 10	
DATE:	JULY 2010				

Domtar

RMT

NORTH CAROLINA, INC.
LICENSE NO. F-0490

NOTES

1. REFER TO PLAN SHEET 1 FOR LEGEND, ABBREVIATIONS AND GENERAL NOTES.
2. THE CONTOURS WITHIN THE LIMITS OF COMPOSITE COVER REPRESENT THE DESIGN TOP OF THE FINAL COVER (FINAL GRADES).
3. COORDINATE GEOMETRY TABLE WILL BE PROVIDED TO THE CONTRACTOR PRIOR TO CONSTRUCTION.

769800N 769600N 769400N 769200N 769000N 768800N 768600N

LANDFILL PERMITTED

MW-12

2659000E 2658800E 2658600E 2658400E 2658200E

EXISTING SEDIMENT POND No. 3

DOWNSLOPE FLUME. REFER TO PLAN SHEET 5 FOR LAYOUT INFORMATION.

2658530E (SEE PLAN SHEET 6)

PRESERVE AND PROTECT CLEANOUT RISERS (TYP.)

DRAINAGE LAYER DISCHARGE PIPE AND OUTLET (TYP.) SEE DETAILS 3/7 4/7

INSTALL TRM (TYP.) SEE DETAIL 2/7

DRAINAGE BENCH (TYP.) SEE DETAIL 2/7

769400N (SEE PLAN SHEET 6)

BLEND PROPOSED ACCESS ROAD INTO EXISTING ACCESS ROAD

EXISTING CONVEYOR SYSTEM (PRESERVE AND PROTECT)

FINAL COVER TERMINATION AT CLEANOUT RISER (TYP.) SEE DETAIL 4/7

ACCESS ROAD CONSTRUCTION/ MODIFICATION (TYP.) SEE DETAIL 5/8

MW-9

FINAL COVER SEE DETAIL 1/7

SURFACE GAS VENT SEE DETAIL 1/8

GVP

ACTIVE PHASE 2

FINAL COVER TERMINATION (SOUTH) SEE DETAIL 6/8

INSTALL BLIND FLANGE FOR FUTURE CONNECTION

BLEND PROPOSED ACCESS ROAD INTO EXISTING ACCESS ROAD

INSTALL EROSION CONTROL FENCE SEE DETAIL 3/8

MW-8

BORROW SITE HAUL ROAD

EXISTING LEACHATE PUMP STATION (TYP.) (PRESERVE AND PROTECT)

INSTALL BLIND FLANGE FOR FUTURE CONNECTION

LIMITS OF COMPOSITE COVER CONSTRUCTION

INSTALL BLIND FLANGE FOR FUTURE CONNECTION

SF

0 50 100 150 200

SCALE 1"= 50 '

NOTE: THE CONTRACTOR SHALL NOTIFY ALL AREA UTILITY COMPANIES PRIOR TO COMMENCING WORK ON THIS CONTRACT, IN ACCORDANCE WITH STATE AND LOCAL REQUIREMENTS.

NOTE: THESE PLANS ARE ACCOMPANIED BY A PROJECT MANUAL OF THE SAME TITLE. THESE DOCUMENTS ARE INTERRELATED AND ARE INTENDED TO BE USED TOGETHER.

NO.	BY	DATE	REVISION	APP'D.
3.				
2.				
1.				

PROJECT: **LANDFILL No. 3 - PHASE 1A & 1B CLOSURE**
DOMTAR PAPER COMPANY, LLC
PLYMOUTH, NORTH CAROLINA

SHEET TITLE:

FINAL GRADES

DRAWN BY:	noldenr	SCALE:		PROJ. NO.	00-71717.41
CHECKED BY:	TDH	1" = 50'		FILE NO.	PH1A&1BFGRADE.PLT
APPROVED BY:	TWM	DATE PRINTED:		SHEET 3 OF 10	
DATE:	JULY 2010				

RMT

NORTH CAROLINA, INC.
LICENSE NO. F-0490

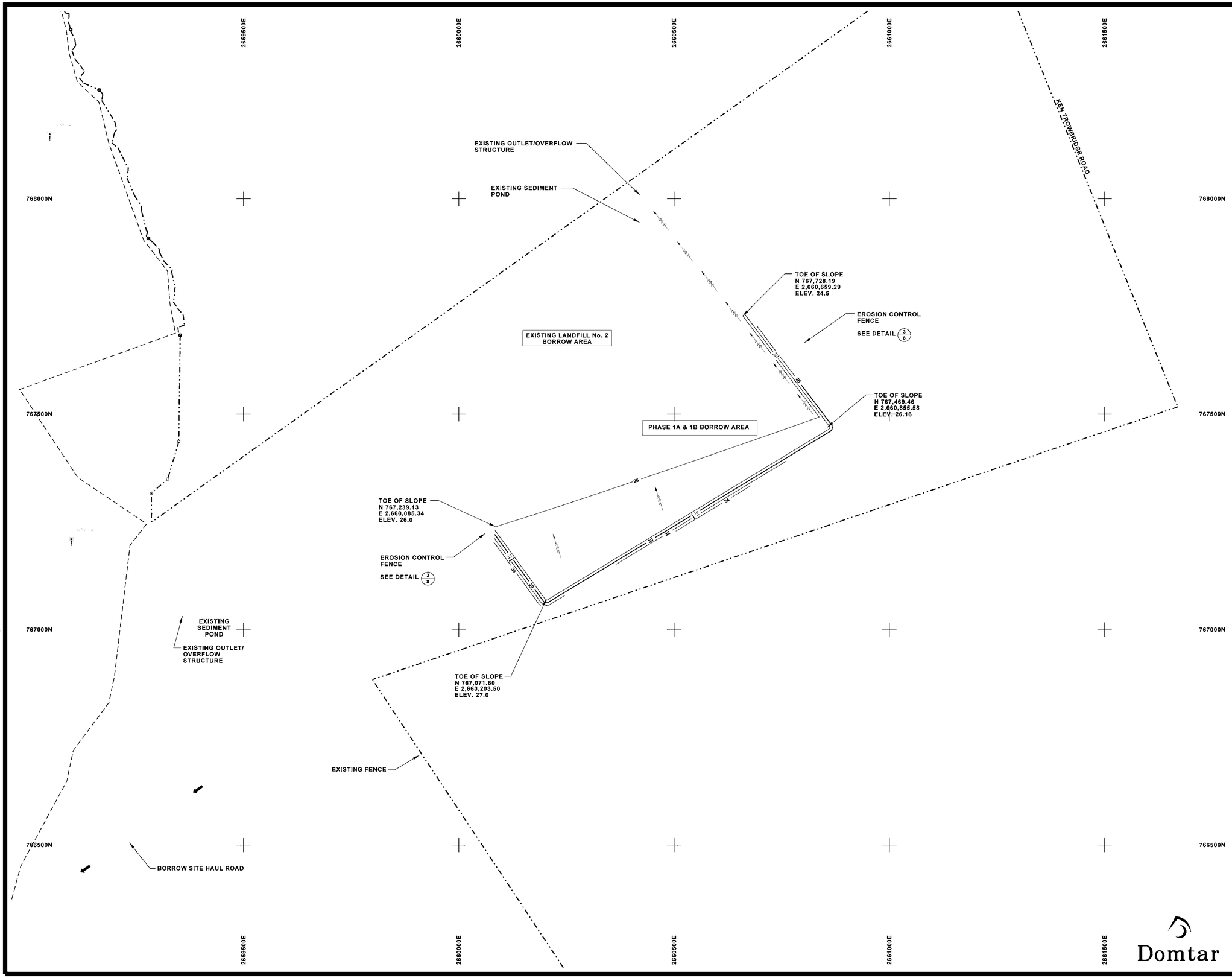
Domtar

Plot Date
Design File: J:\00-71717\41\ph1a&1b\grade.pt
Cell Name: PH1A&1BFGRADE
Plot Scale: 1 = 50 Plot Date: 7/15/2010
Plotter: HP PDF Eng. 400dpi
Pen Table: J:\00-71717\41\ph1a&1b\grade.pt
Paper Size: 11.00 X 8.50 Inches
Position: X 0.000000 Y 0.000000
Plot Time: 10:25:15 2010
Levels On: 1-63

Reference Files
Ref. File 1 - J:\00-71717\41\ref\mesp-4-07-10.dgn
Ref. File 2 - J:\00-71717\41\ref\ceb09-apr-09.dgn
Ref. File 3 - J:\00-71717\41\ref\ceb-ph1a.dgn
Ref. File 4 - J:\00-71717\41\ref\ceb-ph1b.dgn
Ref. File 5 - J:\00-71717\41\ref\ceb-ph2.dgn
Ref. File 6 - J:\00-71717\41\ref\bnd-ph1a.dgn
Ref. File 7 - J:\00-71717\41\ref\bnd-ph1b.dgn
Ref. File 8 - J:\00-71717\41\ref\proposed-aap.dgn
Ref. File 9 - J:\00-71717\41\ref\proposed-aap2.dgn
Ref. File 10 - J:\00-71717\41\ref\ceb-ph1a-gen.dgn
Ref. File 12 - J:\00-71717\41\ref\ceb-ph1b-gen.dgn

Levels
(1) 1-3,5-6,60-63
(2) 16,20-24,36-43,45-48,50-53,56-57
(3) 4,25-31
(4) 1,33-35
(5) 1,3,5-6,3
(6) 1-63
(7) 1-63
(8) 1-63
(9) 1-63
(10) 1-63

Logical Names
Ref. File 1 - mesp
Ref. File 2 - ceb09
Ref. File 3 - ceb-ph1a
Ref. File 4 - ceb-ph1b
Ref. File 5 - ceb-ph2
Ref. File 6 - bnd-ph1a
Ref. File 7 - bnd-ph1b
Ref. File 8 - proposed-aap
Ref. File 9 - proposed-aap2
Ref. File 10 - ceb-ph1a-gen
Ref. File 12 - ceb-ph1b-gen



NOTES

1. REFER TO PLAN SHEET 1 FOR STANDARD LEGEND, ABBREVIATIONS AND GENERAL NOTES.
2. CLEARING AND GRUBBING LIMITS FOR THE BORROW AREA SHALL BE 10' OUTSIDE THE GRADING LIMITS. DISPOSAL AREA FOR CLEARING AND GRUBBING MATERIAL WITHIN THE BORROW AREA TO BE CONFIRMED BY OWNER/ENGINEER PRIOR TO DISPOSAL.
3. BORROW AREA FOR PHASE 1A & 1B CLOSURE CONSTRUCTION SHALL BE EXCAVATED FROM A NORTHEAST TO SOUTHWEST DIRECTION. CONTRACTOR SHALL GRADE THE BOTTOM AREA TO PROVIDE POSITIVE DRAINAGE TO THE EXISTING NORTHEASTERN OUTLET/OVERFLOW STRUCTURE.
4. AFTER BORROW OPERATION IS COMPLETE, ALL DISTURBED AREAS SHALL BE SEEDED IN ACCORDANCE WITH THE SPECIFICATIONS.
5. PROPOSED GRADES SHOWN IN BORROW AREA ARE FOR GENERAL INFORMATION. CONTRACTOR IS TO BORROW MATERIAL IN A LOGICAL SEQUENCE AND PROVIDE POSITIVE DRAINAGE TO THE NORTHEASTERN OUTLET OVERFLOW STRUCTURE AT ALL TIMES.
6. TOPSOIL THAT IS REMOVED FROM THE BORROW AREA AND NOT USED IN THE CLOSURE OF PHASE 1A AND 1B SHALL BE PLACED IN THE TOPSOIL STOCKPILE AREA AS INDICATED ON PLAN SHEET 2.
7. BORROW SITE HAUL ROAD UPGRADES SHALL BE APPROVED BY THE OWNER/ENGINEER PRIOR TO IMPLEMENTATION.
8. EXTRA CLAY OR GENERAL FILL EXCAVATED FROM WITHIN THE BORROW AREA WILL BE STOCKPILED AT LOCATION SHOWN ON PLAN SHEET 2.

0 100 200 300 400

SCALE 1"= 100'

NOTE: THE CONTRACTOR SHALL NOTIFY ALL AREA UTILITY COMPANIES PRIOR TO COMMENCING WORK ON THIS CONTRACT, IN ACCORDANCE WITH STATE AND LOCAL REQUIREMENTS.

NOTE: THESE PLANS ARE ACCOMPANIED BY A PROJECT MANUAL OF THE SAME TITLE. THESE DOCUMENTS ARE INTERRELATED AND ARE INTENDED TO BE USED TOGETHER.

NO.	BY	DATE	REVISION	APP'D.
3.				
2.				
1.				

PROJECT: **LANDFILL No. 3 - PHASE 1A & 1B CLOSURE**
DOMTAR PAPER COMPANY, LLC
PLYMOUTH, NORTH CAROLINA

SHEET TITLE:
BORROW AREA SITE PLAN

DRAWN BY:	noldenr	SCALE:	1" = 100'	PROJ. NO.	00-71717.41
CHECKED BY:	TDH			FILE NO.	BORROW.PLT
APPROVED BY:	TWM	DATE PRINTED:		SHEET 4 OF 10	
DATE:	JULY 2010				

Domtar

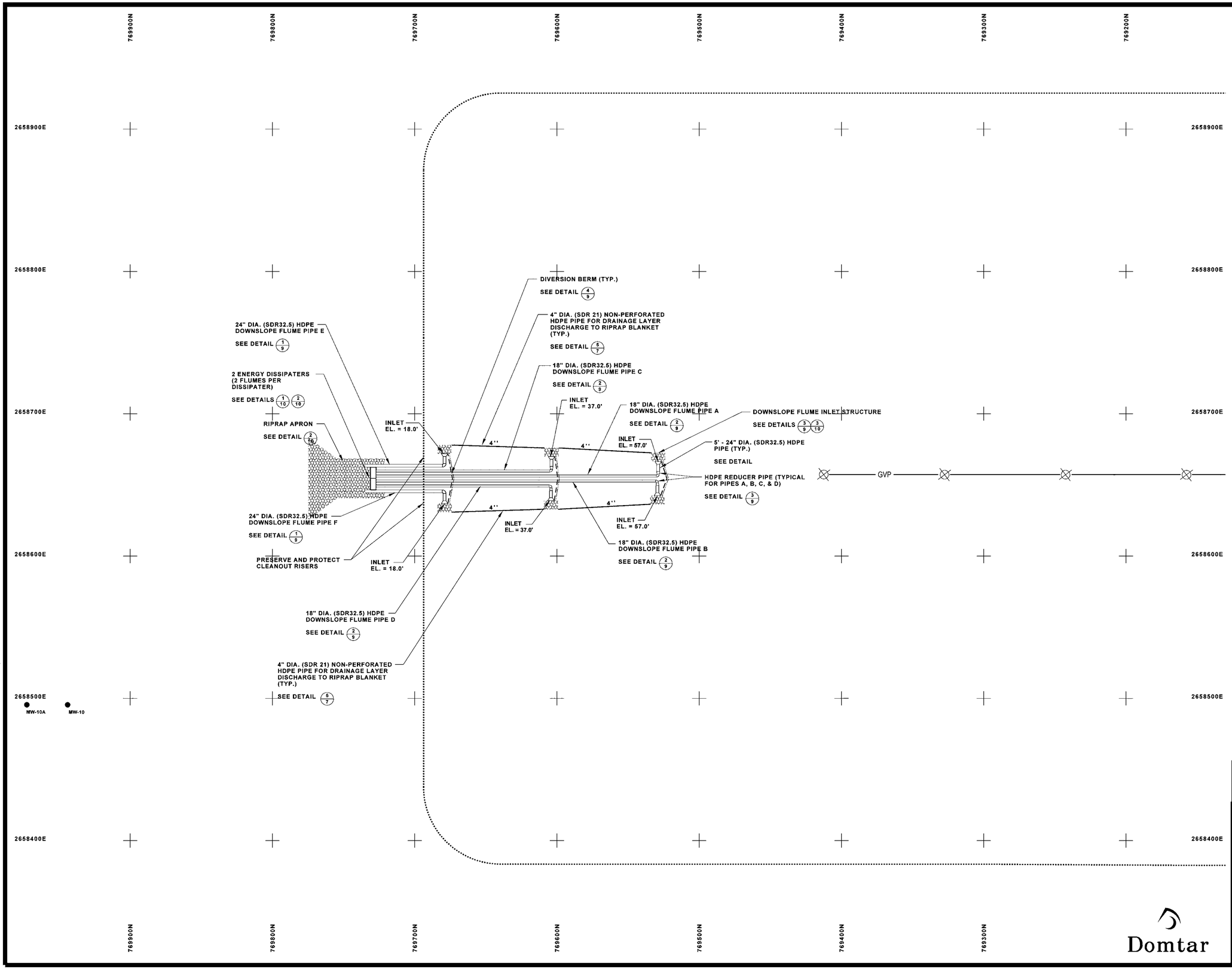
RMT

NORTH CAROLINA, INC.
LICENSE NO. F-0490

Plot Data
Design File: \\00-71717\41\borrow.pl
Cell Library: rmtcellpt.cel
Plot Scale: 1.00-71717.41\borrow.pl
Plot Area: 1.00-71717.41\borrow.pl, MS:0 - VP 1:1
Plotter: us_ansi_b.pltcfg
Pen Table: rmtpen.tbl
Rotation: 0.000000
Origin: 2,660,000.000,767,000.000
Levels On: 1-63
Plot Date: 7-Jul-2010 13:39

Reference Files
Ref File 1: 00-71717.41\ref\newpoints.dgn
Ref File 2: 00-71717.41\ref\newlines.dgn
Ref File 3: 00-71717.41\ref\contours.dgn
Ref File 4: 00-71717.41\ref\contour_ft.dgn
Ref File 5: 00-71717.41\ref\contour_ft_ext.dgn
Ref File 6: 00-71717.41\ref\borrowbndry.dgn
Ref File 7: 00-71717.41\ref\borrow.dgn
Ref File 8: 00-71717.41\ref\proposed.dgn
Ref File 9: 00-71717.41\ref\proposed_upgd.dgn
Ref File 10: 00-71717.41\ref\topo.dgn
Ref File 11: 00-71717.41\ref\topo_ext.dgn
Ref File 12: 00-71717.41\ref\topo_ext_upgd.dgn
Ref File 13: 00-71717.41\ref\topo_ext_upgd_ft.dgn
Ref File 14: 00-71717.41\ref\proposed_upgd.pol
Ref File 15: 00-71717.41\ref\topo_ext_upgd_ft.pol
Ref File 16: <no ref name> (12) <no ref objects>

Logical Names
Level 1: 00-71717.41\borrow*
Level 2: 00-71717.41\borrow\text
Level 3: 00-71717.41\borrow\contours
Level 4: 00-71717.41\borrow\contour_ft
Level 5: 00-71717.41\borrow\contour_ft_ext
Level 6: 00-71717.41\borrow\bndry
Level 7: 00-71717.41\borrow\proposed
Level 8: 00-71717.41\borrow\proposed_upgd
Level 9: 00-71717.41\borrow\topo
Level 10: 00-71717.41\borrow\topo_ext
Level 11: 00-71717.41\borrow\topo_ext_upgd
Level 12: 00-71717.41\borrow\topo_ext_upgd_ft
Level 13: 00-71717.41\borrow\proposed_upgd_ft
Level 14: 00-71717.41\borrow\topo_ext_upgd_ft
Level 15: 00-71717.41\borrow\topo_ext_upgd_ft
Level 16: <no ref name> (12) <no ref objects>
Level 17: 00-71717.41\borrow\topo_ext_upgd_ft
Level 18: 00-71717.41\borrow\topo_ext_upgd_ft
Level 19: 00-71717.41\borrow\topo_ext_upgd_ft
Level 20: 00-71717.41\borrow\topo_ext_upgd_ft
Level 21: 00-71717.41\borrow\topo_ext_upgd_ft
Level 22: 00-71717.41\borrow\topo_ext_upgd_ft
Level 23: 00-71717.41\borrow\topo_ext_upgd_ft
Level 24: 00-71717.41\borrow\topo_ext_upgd_ft
Level 25: 00-71717.41\borrow\topo_ext_upgd_ft
Level 26: 00-71717.41\borrow\topo_ext_upgd_ft
Level 27: 00-71717.41\borrow\topo_ext_upgd_ft
Level 28: 00-71717.41\borrow\topo_ext_upgd_ft
Level 29: 00-71717.41\borrow\topo_ext_upgd_ft
Level 30: 00-71717.41\borrow\topo_ext_upgd_ft
Level 31: 00-71717.41\borrow\topo_ext_upgd_ft
Level 32: 00-71717.41\borrow\topo_ext_upgd_ft
Level 33: 00-71717.41\borrow\topo_ext_upgd_ft
Level 34: 00-71717.41\borrow\topo_ext_upgd_ft
Level 35: 00-71717.41\borrow\topo_ext_upgd_ft
Level 36: 00-71717.41\borrow\topo_ext_upgd_ft
Level 37: 00-71717.41\borrow\topo_ext_upgd_ft
Level 38: 00-71717.41\borrow\topo_ext_upgd_ft
Level 39: 00-71717.41\borrow\topo_ext_upgd_ft
Level 40: 00-71717.41\borrow\topo_ext_upgd_ft
Level 41: 00-71717.41\borrow\topo_ext_upgd_ft
Level 42: 00-71717.41\borrow\topo_ext_upgd_ft
Level 43: 00-71717.41\borrow\topo_ext_upgd_ft
Level 44: 00-71717.41\borrow\topo_ext_upgd_ft
Level 45: 00-71717.41\borrow\topo_ext_upgd_ft
Level 46: 00-71717.41\borrow\topo_ext_upgd_ft
Level 47: 00-71717.41\borrow\topo_ext_upgd_ft
Level 48: 00-71717.41\borrow\topo_ext_upgd_ft
Level 49: 00-71717.41\borrow\topo_ext_upgd_ft
Level 50: 00-71717.41\borrow\topo_ext_upgd_ft
Level 51: 00-71717.41\borrow\topo_ext_upgd_ft
Level 52: 00-71717.41\borrow\topo_ext_upgd_ft
Level 53: 00-71717.41\borrow\topo_ext_upgd_ft
Level 54: 00-71717.41\borrow\topo_ext_upgd_ft
Level 55: 00-71717.41\borrow\topo_ext_upgd_ft
Level 56: 00-71717.41\borrow\topo_ext_upgd_ft
Level 57: 00-71717.41\borrow\topo_ext_upgd_ft
Level 58: 00-71717.41\borrow\topo_ext_upgd_ft
Level 59: 00-71717.41\borrow\topo_ext_upgd_ft
Level 60: 00-71717.41\borrow\topo_ext_upgd_ft
Level 61: 00-71717.41\borrow\topo_ext_upgd_ft
Level 62: 00-71717.41\borrow\topo_ext_upgd_ft
Level 63: 00-71717.41\borrow\topo_ext_upgd_ft



NOTES

1. REFER TO PLAN SHEET 1 FOR LEGEND, ABBREVIATIONS AND GENERAL NOTES.
2. THE CONTOURS WITHIN THE LIMITS OF COMPOSITE COVER REPRESENT THE DESIGN TOP OF THE FINAL COVER (FINAL GRADES).
3. COORDINATE GEOMETRY TABLE WILL BE PROVIDED TO THE CONTRACTOR PRIOR TO CONSTRUCTION.

0 30 60 90 120

SCALE 1" = 30'

NOTE: THE CONTRACTOR SHALL NOTIFY ALL AREA UTILITY COMPANIES PRIOR TO COMMENCING WORK ON THIS CONTRACT, IN ACCORDANCE WITH STATE AND LOCAL REQUIREMENTS.

NOTE: THESE PLANS ARE ACCOMPANIED BY A PROJECT MANUAL OF THE SAME TITLE. THESE DOCUMENTS ARE INTERRELATED AND ARE INTENDED TO BE USED TOGETHER.

NO.	BY	DATE	REVISION	APP'D.
3.				
2.				
1.				

PROJECT: **LANDFILL No. 3 - PHASE 1A & 1B CLOSURE**
DOMTAR PAPER COMPANY, LLC
PLYMOUTH, NORTH CAROLINA

SHEET TITLE:

DOWNSLOPE FLUME LAYOUT

DRAWN BY: noldear	SCALE: 1" = 30'	PROJ. NO.	00-71717.41
CHECKED BY: TDH		FILE NO.	FLUMES.PLT
APPROVED BY: TWM	DATE PRINTED:	SHEET 5 OF 10	
DATE: JULY 2010			

Domtar

RMT

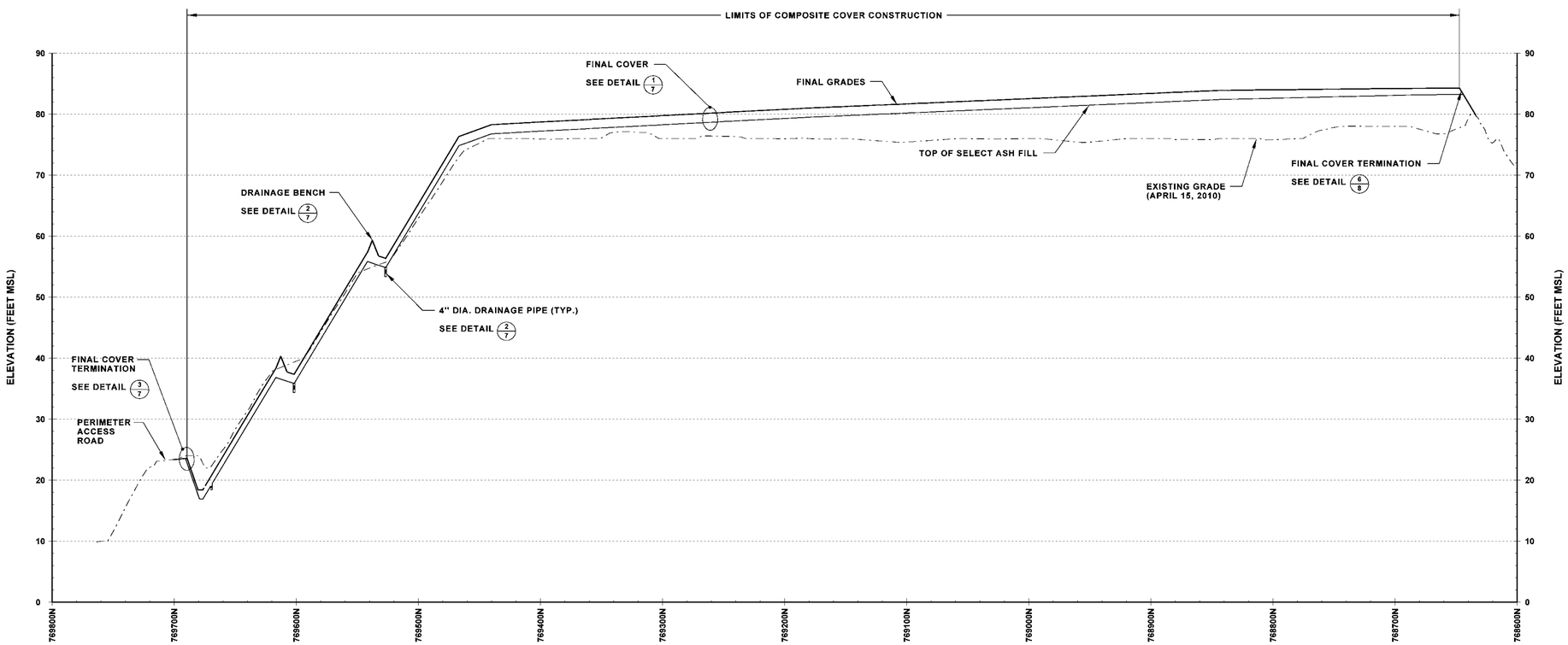
NORTH CAROLINA, INC.
LICENSE NO. F-0490

Plot Data
Design File: 00-71717-41-flumes.pgl
Level Group: Flume
Plot Scale: 1:000-71717-41\flumes.PGL
Plot Date: 12-Jul-2010 11:11:11 MST-8 - KP 7-7-16
Plotter: HP 8500 (B/W 400dpi)
Scale: 1.000000
Rotation: 0.000000
Origin: 0.000000, 0.000000
Levels On: 1-63 Left-2 200

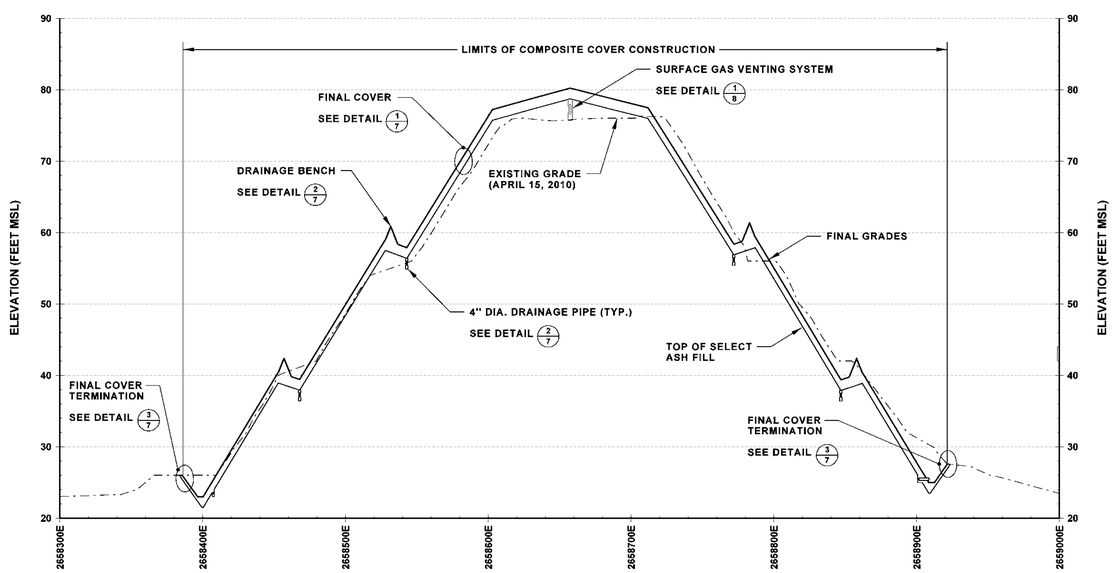
Reference Files
Ref File 1: J:\00-71717-41\ref\margin4-01.dgn
Ref File 2: J:\00-71717-41\ref\ref00-gp.dgn
Ref File 3: J:\00-71717-41\ref\ref00-gp\00bbmap.dgn
Ref File 4: J:\00-71717-41\ref\ref00-gp\01.dgn
Ref File 5: J:\00-71717-41\ref\ref00-gp\02.dgn
Ref File 6: J:\00-71717-41\ref\ref00-gp\03.dgn
Ref File 7: J:\00-71717-41\ref\ref00-gp\04.dgn
Ref File 8: J:\00-71717-41\ref\ref00-gp\05.dgn
Ref File 9: J:\00-71717-41\ref\ref00-gp\06.dgn
Ref File 10: J:\00-71717-41\ref\ref00-gp\07.dgn
Ref File 11: J:\00-71717-41\ref\ref00-gp\08.dgn
Ref File 12: J:\00-71717-41\ref\ref00-gp\09.dgn

Logical Names
Levels
(1) 1-63 Left-58 60-63
(2) -16-20 24-26 43-48 50-53,56-62
(3) 1-2 4-5
(4) 1-63 -63
(5) 1-2 4-5
(6) 1-63 -63
(7) 1-63 -63
(8) -63 1-3
(9) 1-63
(10) 1-63

Logical Names
Ref File 1: margin4-01
Ref File 2: ref00-gp
Ref File 3: 00bbmap
Ref File 4: 01
Ref File 5: 02
Ref File 6: 03
Ref File 7: 04
Ref File 8: 05
Ref File 9: 06
Ref File 10: 07
Ref File 11: 08
Ref File 12: 09



SECTION - 2658630E



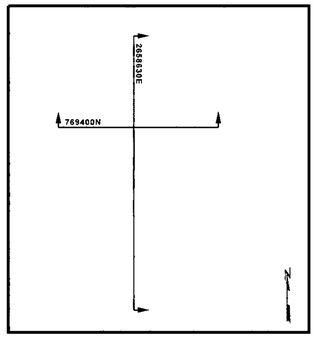
SECTION - 769400N

LEGEND

- TOP OF TOPSOIL
- TOP OF SELECT ASH FILL
- EXISTING GRADE

NOTES

1. REFER TO PLAN SHEET 1 FOR BASE MAP NOTES.
2. EXISTING GRADE ELEVATIONS AE BASED ON TOPOGRAPHIC SURVEY PERFORMED BY CHANCE & ASSOCIATES, INC., NEW BERRY, NC. DATE OF SURVEY: APRIL 15, 2010.
3. PREFER TO PLAN SHEET 3 FOR FINAL GRADES.



CROSS SECTION LOCATOR

NOTE: THE CONTRACTOR SHALL NOTIFY ALL AREA UTILITY COMPANIES PRIOR TO COMMENCING WORK ON THIS CONTRACT, IN ACCORDANCE WITH STATE AND LOCAL REQUIREMENTS.

NOTE: THESE PLANS ARE ACCOMPANIED BY A PROJECT MANUAL OF THE SAME TITLE. THESE DOCUMENTS ARE INTERRELATED AND ARE INTENDED TO BE USED TOGETHER.

NO.	BY	DATE	REVISION	APP'D.
3.				
2.				
1.				

PROJECT: **LANDFILL No. 3 - PHASE 1A & 1B CLOSURE**
DOMTAR PAPER COMPANY, LLC
PLYMOUTH, NORTH CAROLINA

SHEET TITLE:
ENGINEERING CROSS SECTIONS 769400N & 2658630E

DRAWN BY: noldenr	SCALE:	PROJ. NO.	00-71717.41
CHECKED BY: TDH	AS SHOWN	FILE NO.	XSECTION.PLT
APPROVED BY: TWM	DATE PRINTED:	SHEET 6 OF 10	
DATE: JULY 2010			

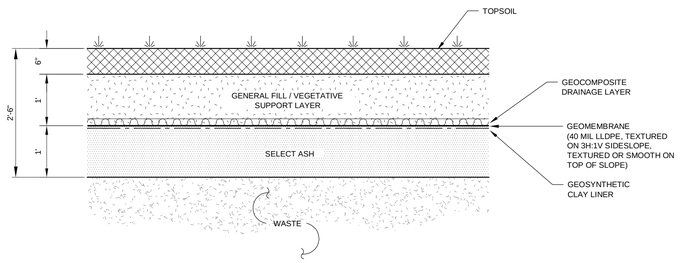
PROFILE SCALE:
VERTICAL 10 0 SCALE: 1"=10'
HORIZONTAL 0 50 SCALE: 1"=50'

Domtar

RMT

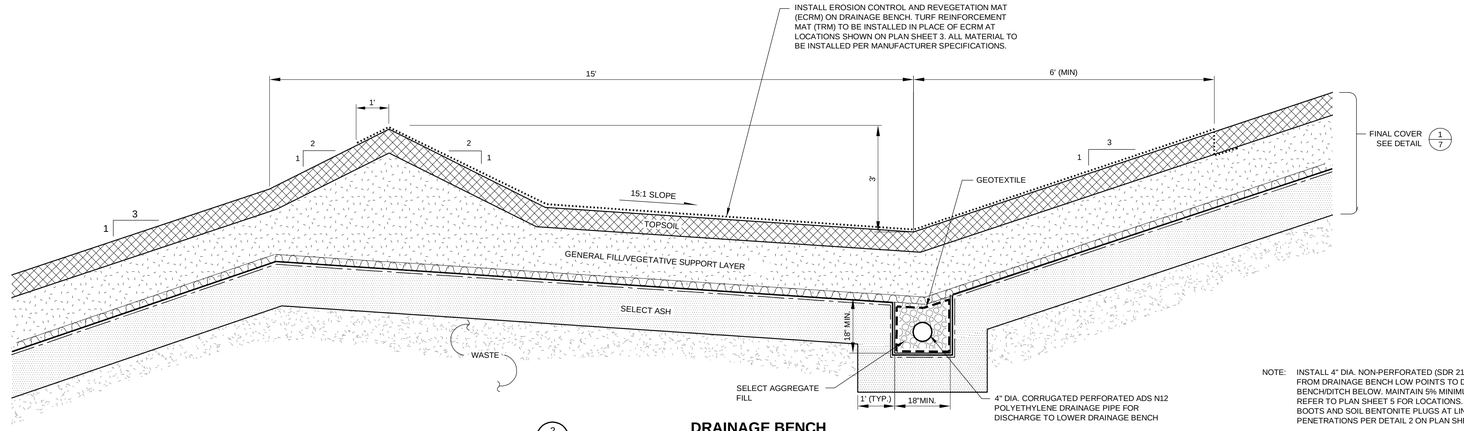
NORTH CAROLINA, INC.
LICENSE NO. F-0490

Plot Date
Design File: J:\00-71717\41\section.pt
Cell Name: XSECTION
Ref Files: J:\00-71717\41\section.dgn
J:\00-71717\41\section.dgn
Plot Scale: 1.000000
Plotter: WG PDF Ble 400dpi
Pen Table: PLOTTER.TBL
Position: 0.000000,0.000000
Plot Area: Active Area
Levels On: 1-63
Levels
Logical Names
Reference Files



1/7 **FINAL COVER**

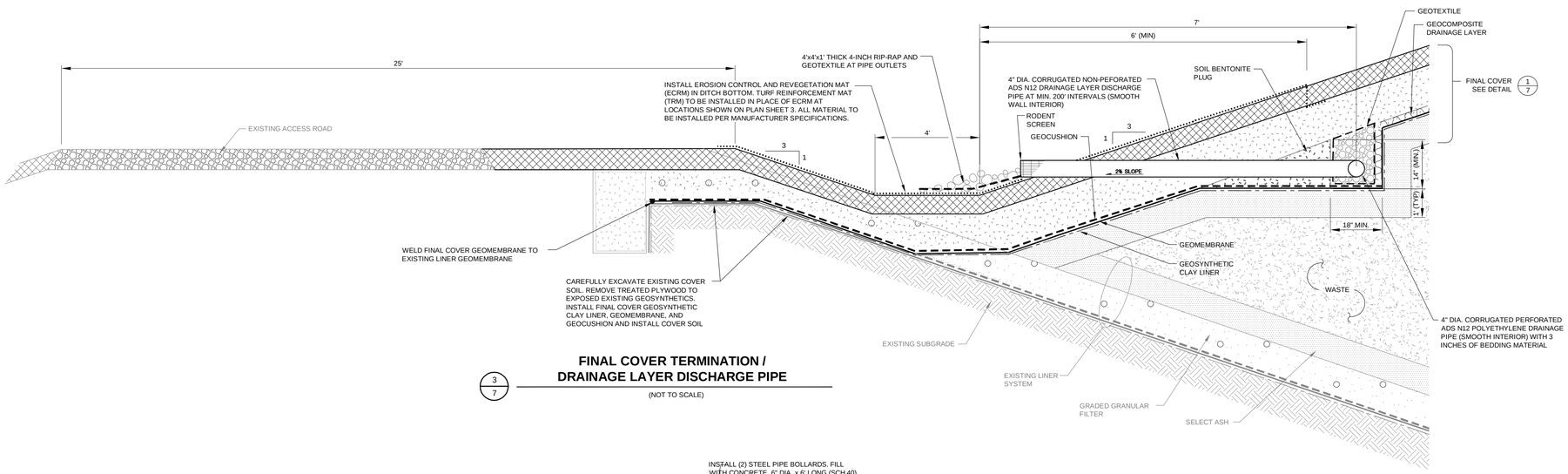
(NOT TO SCALE)



NOTE: INSTALL 4" DIA. NON-PERFORATED (SDR 21) HDPE PIPE FROM DRAINAGE BENCH LOW POINTS TO DRAINAGE BENCH/DITCH BELOW. MAINTAIN 5% MINIMUM PIPE SLOPE. REFER TO PLAN SHEET 5 FOR LOCATIONS. INSTALL PIPE BOOTS AND SOIL BENTONITE PLUGS AT LINER PENETRATIONS PER DETAIL 2 ON PLAN SHEET 8.

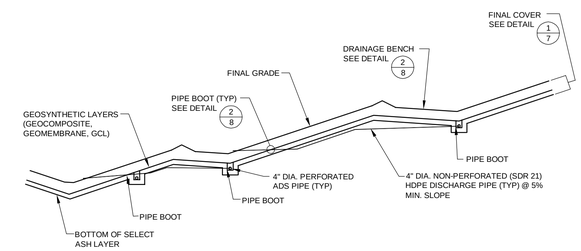
2/7 **DRAINAGE BENCH**

(NOT TO SCALE)



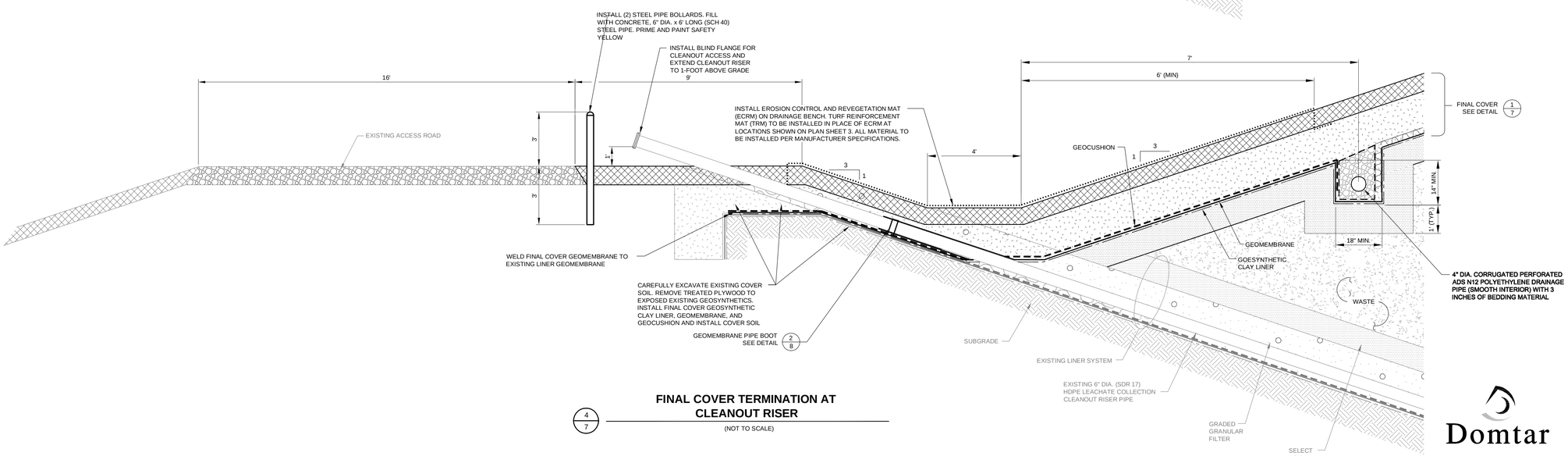
3/7 **FINAL COVER TERMINATION / DRAINAGE LAYER DISCHARGE PIPE**

(NOT TO SCALE)



5/7 **DRAINAGE BENCH DRAINAGE LAYER DISCHAGRE PIPE**

(NOT TO SCALE)



4/7 **FINAL COVER TERMINATION AT CLEANOUT RISER**

(NOT TO SCALE)

LINE AND SHADING LEGEND

- GEOTEXTILE
- GEOMEMBRANE
- GEOCOMPOSITE
- GEOSYNTHETIC CLAY LINER
- EROSION CONTROL VEGETATION MAT (ECRM)
- SELECT ASH
- SELECT AGGREGATE FILL
- AGGREGATE BASE COURSE
- SELECT GRADED FILL (FILTER)
- TOPSOIL
- COMPACTED SELECT CLAY FILL
- NATIVE SOIL
- CONCRETE
- GENERAL FILL
- WASTE

NOTE: THE CONTRACTOR SHALL NOTIFY ALL AREA UTILITY COMPANIES PRIOR TO COMMENCING WORK ON THIS CONTRACT, IN ACCORDANCE WITH STATE AND LOCAL REQUIREMENTS.

NOTE: THESE PLANS ARE ACCOMPANIED BY A PROJECT MANUAL OF THE SAME TITLE. THESE DOCUMENTS ARE INTERRELATED AND ARE INTENDED TO BE USED TOGETHER.

NO.	BY	DATE	REVISION	APP'D.
3.				
2.				
1.				

PROJECT NAME:
LANDFILL No. 3 - PHASE 1A & 1B CLOSURE DOMTAR
PAPER COMPANY, LLC PLYMOUTH, NORTH CAROLINA

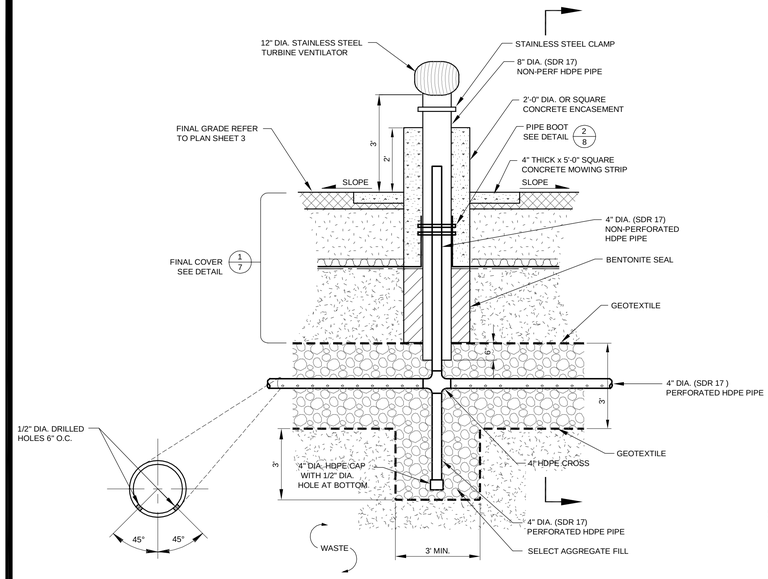
SHEET TITLE:
DETAILS

DRAWN BY: EPF	SCALE: NOT TO SCALE	PROJECT NO: J:\00-71717\41	
CHECKED BY: TDH		FILE NO: 71717.41.06-10.dwg	
APPROVED BY: TWM	DATE PRINTED:	SHEET 7 OF 10	
DATE: July 2010			

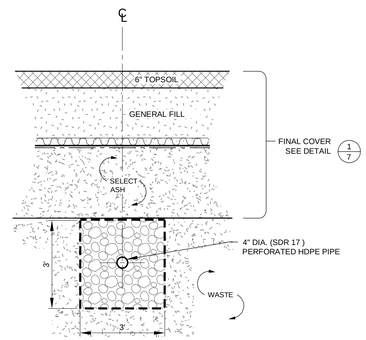
RMT NORTH CAROLINA INC.
LICENSE NO. F-0490

Domtar

PLOT DATA:
Drawing Name: J:\00-71717\41\71717.41.06-10.dwg
Operator Name: FITZGERALD, ERIC
Drawing Size: 8x14(IN)
Dwg Size: 1.06 MB
Plot Date: July 23, 2010
Plot Time: 3:27 PM
Attached Xref's:
Attached Images:
Layout: dom-section.dft
Dwg(1/1)



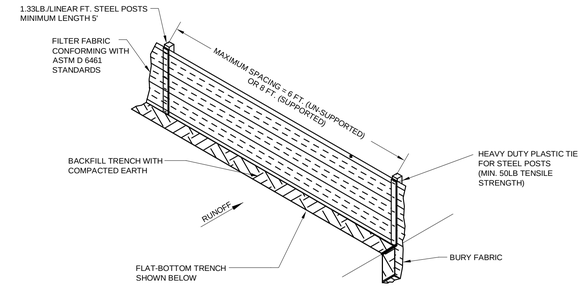
SECTION THROUGH GAS VENT



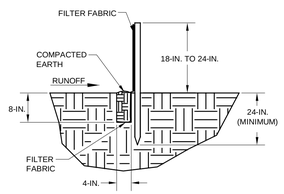
SECTION THROUGH GAS VENTING TRENCH

1/8 **SURFACE GAS VENTING SYSTEM**

(NOT TO SCALE)



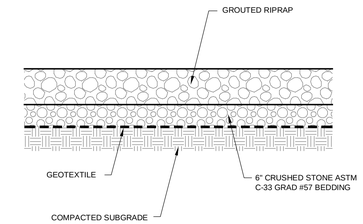
SILT FENCE INSTALLATION



FLAT-BOTTOM TRENCH DETAIL

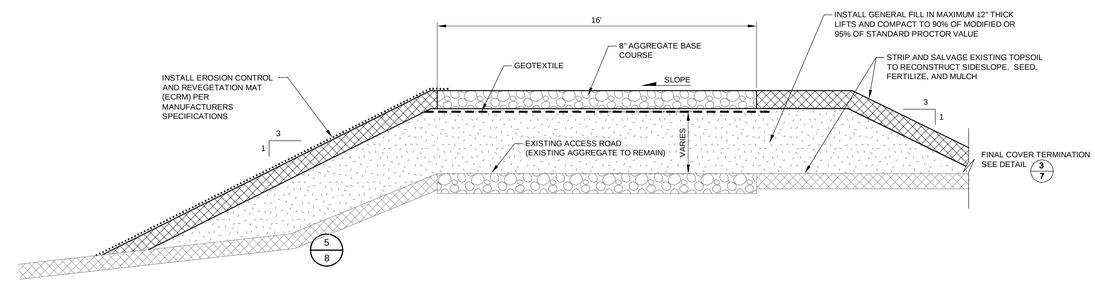
3/8 **EROSION CONTROL FENCE**

(NOT TO SCALE)



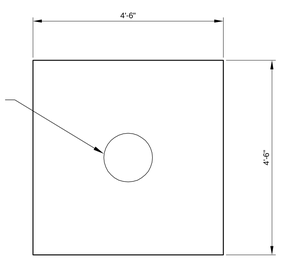
4/8 **GROUTED RIP RAP**

(NOT TO SCALE)

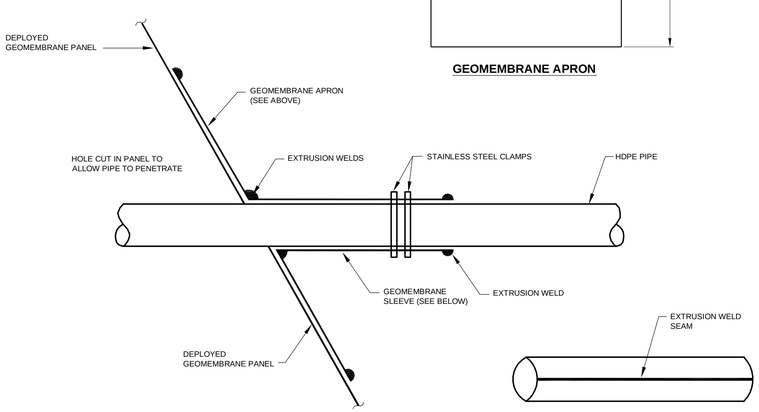


5/8 **ACCESS ROAD MODIFICATION**

(NOT TO SCALE)



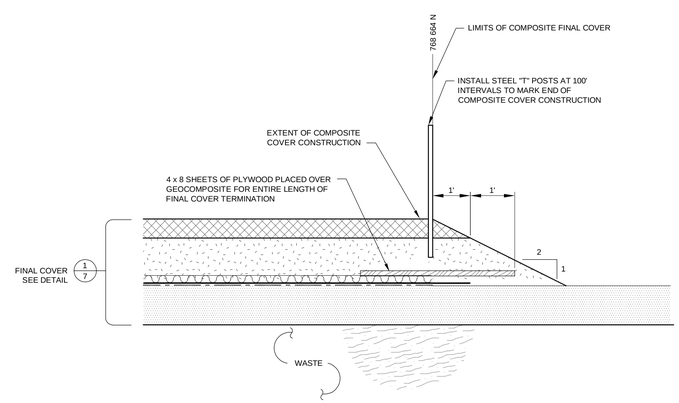
GEOMEMBRANE APRON



GEOMEMBRANE SLEEVE

2/8 **HDPE PIPE BOOT**

(NOT TO SCALE)



6/8 **FINAL COVER TERMINATION (SOUTH)**

(NOT TO SCALE)

LINE AND SHADING LEGEND

- GEOTEXTILE
- GEOMEMBRANE
- GEOCOMPOSITE
- GEOSYNTHETIC CLAY LINER
- EROSION CONTROL VEGETATION MAT (ECRM)
- SELECT ASH
- SELECT AGGREGATE FILL
- AGGREGATE BASE COURSE
- SELECT GRADED FILL (FILTER)
- TOPSOIL
- COMPACTED SELECT CLAY FILL
- NATIVE SOIL
- CONCRETE
- GENERAL FILL
- WASTE

NOTE: THE CONTRACTOR SHALL NOTIFY ALL AREA UTILITY COMPANIES PRIOR TO COMMENCING WORK ON THIS CONTRACT, IN ACCORDANCE WITH STATE AND LOCAL REQUIREMENTS.

NOTE: THESE PLANS ARE ACCOMPANIED BY A PROJECT MANUAL OF THE SAME TITLE. THESE DOCUMENTS ARE INTERRELATED AND ARE INTENDED TO BE USED TOGETHER.

NO.	BY	DATE	REVISION	APP'D.
3.				
2.				
1.				

PROJECT NAME:
LANDFILL No. 3 - PHASE 1A & 1B CLOSURE DOMTAR
PAPER COMPANY, LLC PLYMOUTH, NORTH CAROLINA

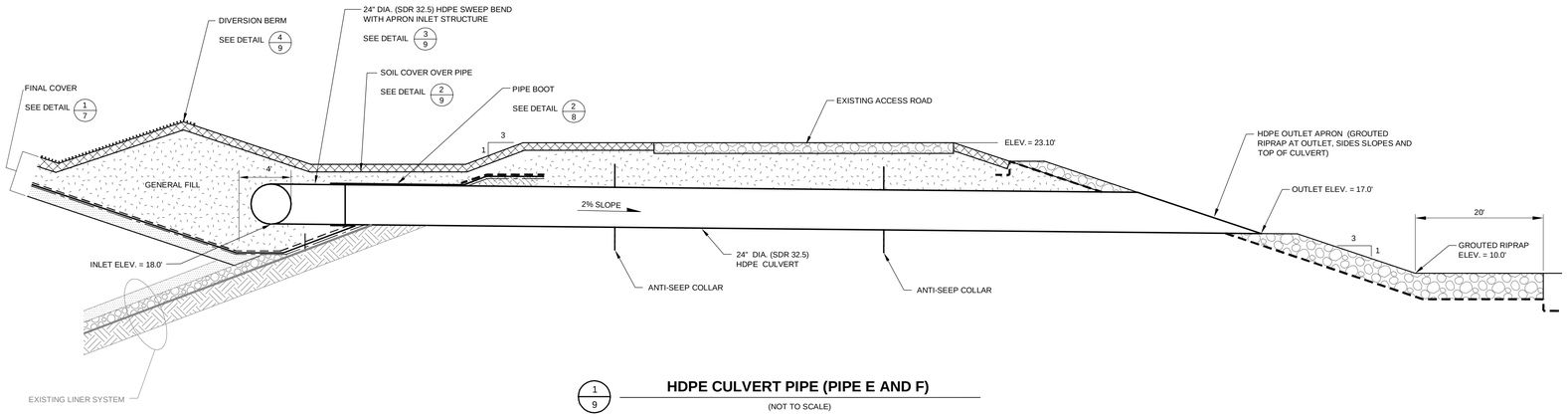
SHEET TITLE:
DETAILS

DRAWN BY: EPF	SCALE: NOT TO SCALE	PROJECT NO: J:\100-71717\41	
CHECKED BY: TDH		FILE NO: 71717.41.06-10.dwg	
APPROVED BY: TWM	DATE PRINTED:	SHEET 8 OF 10	
DATE: July 2010			

Domtar

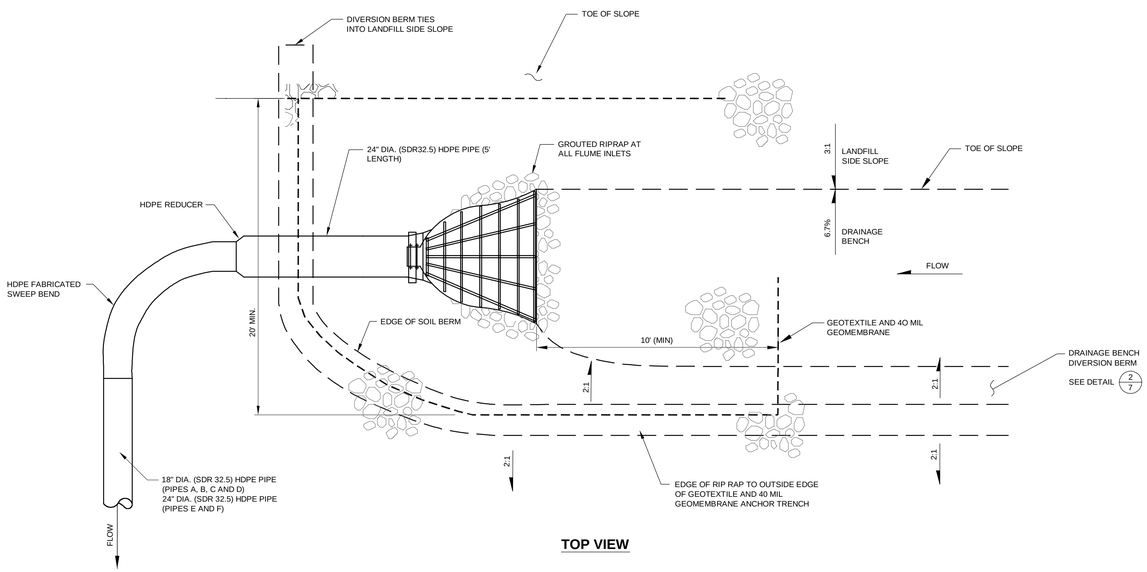
RMT NORTH CAROLINA INC.
LICENSE NO. F-0490

PLOT DATA:
Drawing Name: J:\100-71717\41\71717.41.06-10.dwg
Operator Name: FITZGERALD, ERIC
Drawing Size: 8.5x11
Dwg Scale: 1:06 MB
Plot Date: July 23, 2010
Plot Time: 15:43:54
Attached Xref's:
Attached Images:
Layout
dom-section.lift
Phase-IB

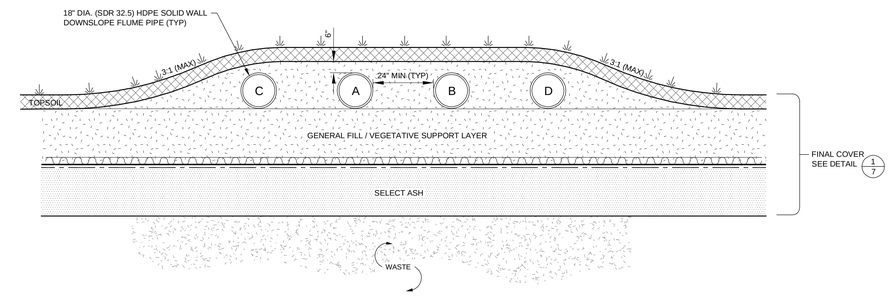


1/9 **HDPE CULVERT PIPE (PIPE E AND F)**

(NOT TO SCALE)



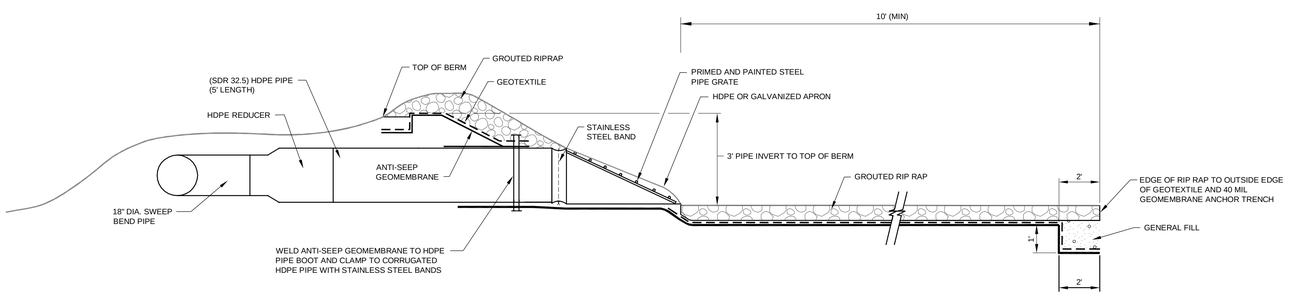
TOP VIEW



NOTE:
1. INSTALL 12" MINIMUM SOIL COVER REQUIRED ABOVE PIPES.
2. PIPES E AND F ARE NOT DEPICTED IN THIS DETAIL.

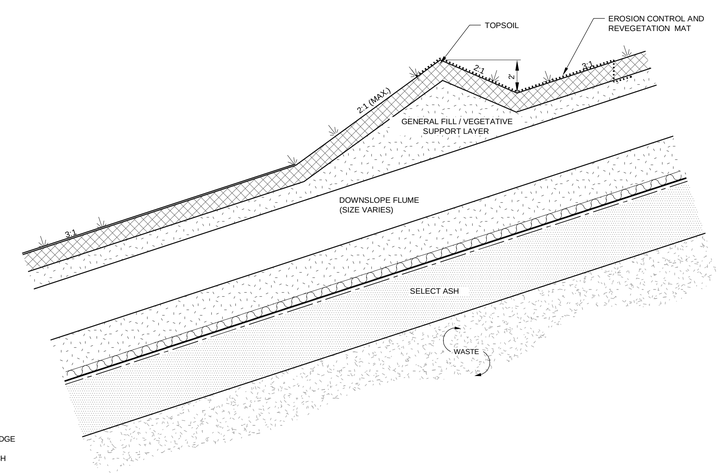
2/9 **DOWNSLOPE FLUME / FINAL COVER SECTION**

(NOT TO SCALE)



3/9 **DOWNSLOPE FLUME INLET STRUCTURE**

(NOT TO SCALE)



4/9 **DIVERSION BERM**

(NOT TO SCALE)

LINE AND SHADING LEGEND

- GEOTEXTILE
- GEOMEMBRANE
- GEOCOMPOSITE
- GEOSYNTHETIC CLAY LINER
- EROSION CONTROL VEGETATION MAT (ECRM)
- SELECT ASH
- SELECT AGGREGATE FILL
- AGGREGATE BASE COURSE
- SELECT GRADED FILL (FILTER)
- TOPSOIL
- COMPACTED SELECT CLAY FILL
- NATIVE SOIL
- CONCRETE
- GENERAL FILL
- WASTE

NOTE: THE CONTRACTOR SHALL NOTIFY ALL AREA UTILITY COMPANIES PRIOR TO COMMENCING WORK ON THIS CONTRACT, IN ACCORDANCE WITH STATE AND LOCAL REQUIREMENTS.

NOTE: THESE PLANS ARE ACCOMPANIED BY A PROJECT MANUAL OF THE SAME TITLE. THESE DOCUMENTS ARE INTERRELATED AND ARE INTENDED TO BE USED TOGETHER.

NO.	BY	DATE	REVISION	APP'D.
3.				
2.				
1.				

PROJECT NAME:
LANDFILL No. 3 - PHASE 1A & 1B CLOSURE DOMTAR PAPER COMPANY, LLC PLYMOUTH, NORTH CAROLINA

SHEET TITLE:
DETAILS

DRAWN BY: EPF	SCALE: NOT TO SCALE	PROJECT NO: J:\00-71717\41	
CHECKED BY: TDH		FILE NO: 71717.41.06-10.dwg	
APPROVED BY: TWM	DATE PRINTED:	SHEET 9 OF 10	
DATE: July 2010			

Domtar

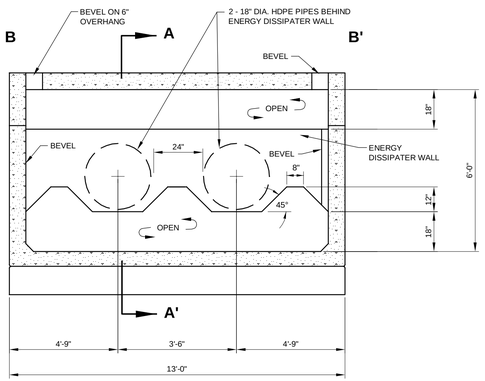
RMT NORTH CAROLINA INC.
LICENSE NO. F-0490

PLOT DATA:
Drawing Name: J:\00-71717\41-06-10.dwg
Operator Name: FITZGERALD, ERIC
Drawing Plot Date: 8/13/2010

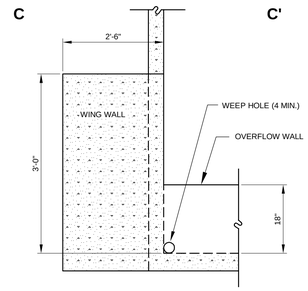
Dwg Size: 1.05 Mb
Plot Date: July 23, 2010
Plot Time: 2:19 PM

Attached Xref's:
Attached Images:
Layout:

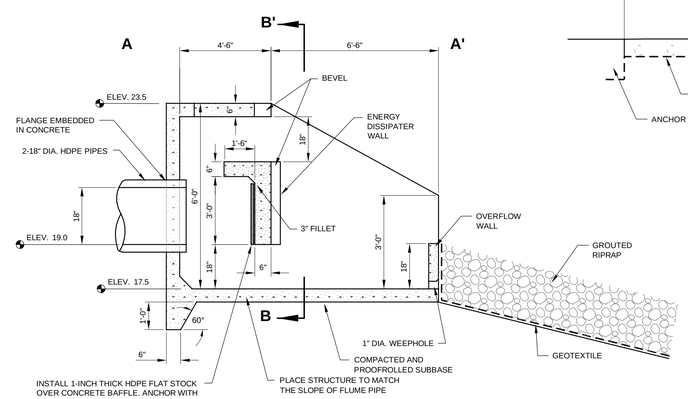
dom-sections.dwt
Dwg:(9)



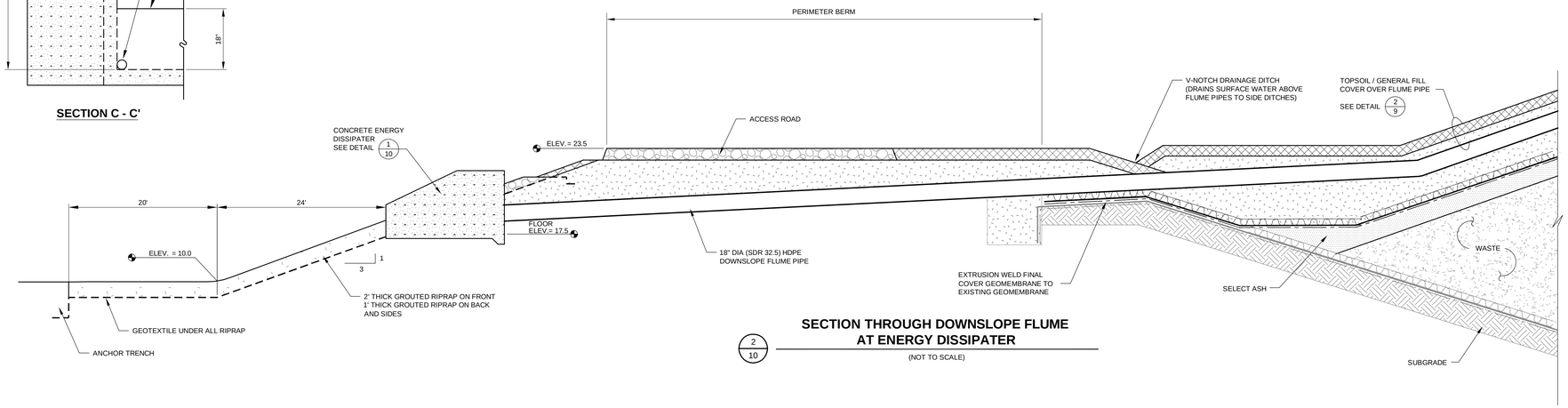
SECTION B - B'



SECTION C - C'

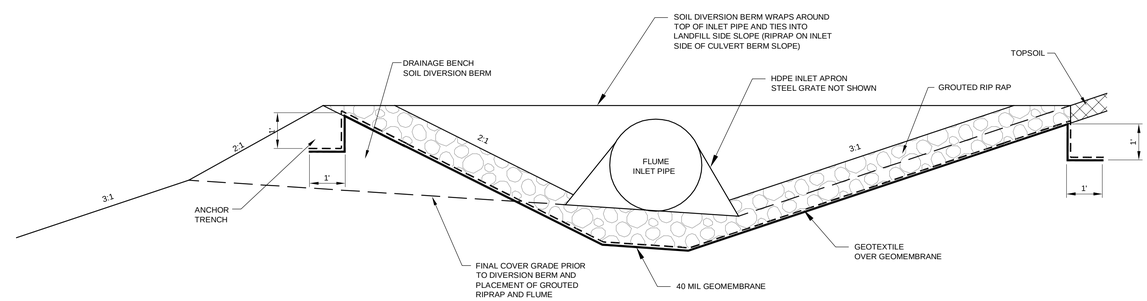


SECTION A - A'



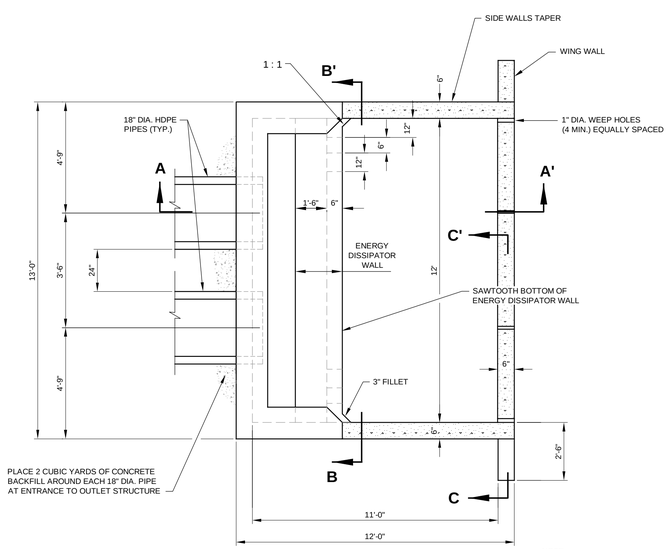
2/10 SECTION THROUGH DOWNSLOPE FLUME AT ENERGY DISSIPATER

(NOT TO SCALE)



3/10 DOWNSLOPE FLUME INLET STRUCTURE VIEWED FACING PIPE INLET

(NOT TO SCALE)



PLAN VIEW

NOTE:

1. CONTRACTOR TO SUPPLY SHOP DRAWINGS TO ENGINEER FOR APPROVAL PRIOR TO FABRICATION. DIMENSIONS ARE MINIMUM AND CAN BE MODIFIED BASED ON MANUFACTURER'S RECOMMENDATIONS.

1/10 DOWNSLOPE FLUME A, B, C, AND D OUTLET ENERGY DISSIPATER

(NOT TO SCALE)

LINE AND SHADING LEGEND

- GEOTEXTILE
- GEOMEMBRANE
- GEOCOMPOSITE
- GEOSYNTHETIC CLAY LINER
- EROSION CONTROL VEGETATION MAT (ECRM)
- SELECT ASH
- SELECT AGGREGATE FILL
- AGGREGATE BASE COURSE
- SELECT GRADED FILL (FILTER)
- TOPSOIL
- COMPACTED SELECT CLAY FILL
- NATIVE SOIL
- CONCRETE
- GENERAL FILL
- WASTE

NOTE: THE CONTRACTOR SHALL NOTIFY ALL AREA UTILITY COMPANIES PRIOR TO COMMENCING WORK ON THIS CONTRACT, IN ACCORDANCE WITH STATE AND LOCAL REQUIREMENTS.

NOTE: THESE PLANS ARE ACCOMPANIED BY A PROJECT MANUAL OF THE SAME TITLE. THESE DOCUMENTS ARE INTERRELATED AND ARE INTENDED TO BE USED TOGETHER.

NO.	BY	DATE	REVISION	APP'D.
3.				
2.				
1.				

PROJECT NAME:
LANDFILL No. 3 - PHASE 1A & 1B CLOSURE DOMTAR PAPER COMPANY, LLC PLYMOUTH, NORTH CAROLINA

SHEET TITLE:
DETAILS

DRAWN BY: EPF	SCALE: NOT TO SCALE	PROJECT NO: J:\100-71717\41	
CHECKED BY: TDH		FILE NO: 71717.41.06-10.dwg	
APPROVED BY: TWM	DATE PRINTED:	SHEET 10 OF 10	
DATE: July 2010			

Domtar

RMT NORTH CAROLINA INC.
LICENSE NO. F-0490

PLOT DATA:
Drawing Name: J:\100-71717\71717-41.06-10.dwg
Operator Name: FITZGERALD, ERIC
Drawing Size: 8.5x11
Dwg Scale: 1:06 MB
Plot Date: July 23, 2010
Plot Time: 15:34:54
Attached Xref's:
Attached Images:
Layout: dom-section.dft
Sheet:1/10